Grumman Gulfstream
Detail Specifications

Grumman

GRUMMAN GULFSTREAM

DETAIL SPECIFICATION

REVISION 'F'

September 1, 1965

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

Bethpage, N.Y.

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1.0 INTRODUCTION

1.1 Type, Model and Criteria. -

Basic Type	- Commercial Transport Airplane	
Manufacturer's Model No.	- Grumman Aircraft Engineering Corporation Model G159 Gulfstream	F
Number of Places	- 2 Crew	
	- 19 Passengers (Maximum)	
	- 24 Passengers (When emergency exists are modified by Service Change No. 153)	
Engines	- 2 Rolls-Royce Dart Mark 529-8X	

1.2 Utility. - Transportation of passengers and cargo.

1.3 Airplane Summary. - The airplane shall be an all-metal two engine, low wing monoplane designed for use as a passenger transport and arranged essentially as shown on page 2.

1.4 Abbreviations. - Reference to "C.A.R." and "F.A.A." throughout this specification shall be understood to mean Civil Air Regulations and the Federal Aviation Agency, respectively, as promulgated by the United States Civil Aeronautics Board. Reference to "G.A.E.C." throughout this specification shall be understood to mean Grumman Aircraft Engineering Corporation.

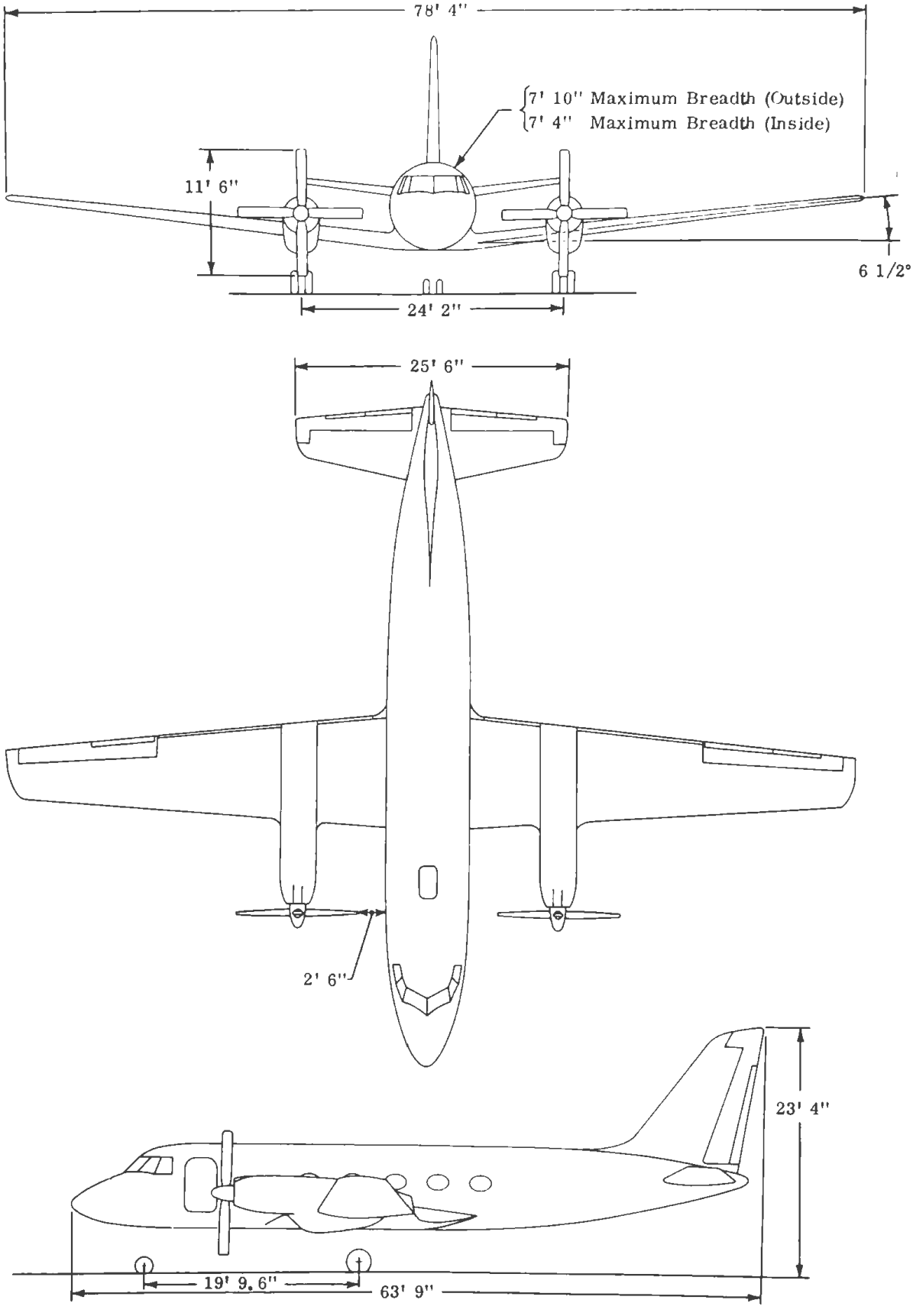
1.5 Definitions

1.5.1 Space Provision for. - "Space provision for" a specific installation means that space only shall be allocated for the installation, and that brackets, bolt holes, electrical wiring, hydraulic lines, etc., will not be furnished. "Space provision for" does not imply that adequate attaching structure is provided, unless otherwise stated.

1.5.2 Shall be Provided. - The expression "shall be provided" means that the item or equipment is to be furnished and installed by G.A.E.C.

1.6 Minor Changes. - G.A.E.C. reserves the right to make minor changes and corrections to the airplane and this specification where such changes are deemed necessary to correct defects, improve the product or prevent delay in delivery. Minor changes shall be those which do not affect the Purchase Agreement of which this specification forms a part.

1.7 Drawings. - The drawings shown in this specification are typical designs. As such they do not necessarily represent the delivered product.



General Arrangement

2.0 GENERAL REQUIREMENTS

2.1 General

2.1.1 The prototype airplanes shall have received appropriate Type and Airworthiness Certification from the Federal Aviation Agency of the United States for an airplane of the transport category. The airplane described in this detail specification and furnished to the distributor shall also be certified by the Federal Aviation Agency as an airplane of the transport category.

2.1.2 Any mandatory and retroactive safety change in civil air regulations necessary to the Airworthiness Certification of the airplane shall serve as a basis for adjustment of performance and weight guarantees.

2.1.3 G.A.E.C. reserves the right to substitute equivalent equipment, accessories, materials of construction, or design whenever it is deemed that such substitution is necessary to prevent delay in manufacture or delivery, or meet requirements of the F.A.A. or whenever G.A.E.C. deems that such substitution will improve the performance, stability, control, utility, maintenance and appearance of the airplane or installation.

2.2 Applicable Specifications. - The following specifications shall be applicable:

2.2.1 Civil Aeronautics Board's Regulations and Administratives for airplanes of the transport category.

1. Part 4b "Airplane Airworthiness, Transport Categories", dated December 31, 1953, including Amendments 1 through 5.

2. F.A.A. Special Regulation No. SR-422A, "Turbine Powered Transport Category Airplanes of Current Design," dated July 2, 1958.

3. Additional requirements as imposed by Region 1 of the F.A.A. and listed in F.A.A. letter NY-235, "Basis for Type Certification of G-159", dated December 2, 1957.

2.2.2 G.A.E.C. Specifications where applicable:

1. Grumman Process Specifications

2. Grumman Standard Specifications: GSS 9010A in conformance with MIL-C-5541.

3. Grumman Quality Control Procedures

4. G.A.E.C. Finish and Sealing Specification for Gulfstream (G-159) Airplanes: SP-FS-159-2

2.2 (Cont.)

2.2.3 Rolls-Royce Engine Specifications

1. Dart RDa7 and RDa8 Engine Performance Specification and Installation Notes T.S.D 1315, dated June 196 Amended to April 1964 (Executive RDa7)

2. Dart RDa7H and RDa8H Engine Performance Specification and Installation Notes T.S.D. 1315 Addendum No. 1, dated July 1964.

3. Contract Specification No. 5068 Issue 2, dated March 1964 Dart Mark 529-8H Engine for Grumman Gulfstream Aircraft.

2.2.4 Rotol Propeller

1. Design Spec. No. 57 DS.0015 January 13, 1958 Propeller Equipment for Grumman Gulfstream.

2. Performance Office Report No. 1040. Issue 4, dated June 1959.

2.3 External Finish and Markings. - The exterior surfaces except as subsequently specified, shall receive a chemical conversion coating (Alodine 1200) per G.S.S. 9010A in accordance with Specification MIL-C-5541 (G.A.E.C. Finish No. 76), followed by a single coat of G.A.E.C. Primer (Epoxy) No. 1012, except for smooth painted areas required for normal operational, maintenance and anti-corrosion purposes in accordance with par. 2.2 and sub-paragraph 2.2.2(4). Exceptions to the foregoing are the nacelle, main wheel doors and cowling (except Vickers) which shall be finished with G.A.E.C. Finish No. 76 (Alodine 1200) only. Other exceptions or additional external finish and special markings shall be subject to separate negotiation. Registration marks shall be affixed in conformance with Section 1.100 of C.A.R.

2.4 Units of Measure. - All units of measure given in this specification, unless otherwise noted, are U.S. units.

2.5 Signs, Placards, Nameplates. - All placards, nameplates, signs, stencils, instructions, etc., shall be in English with U.S. units, unless otherwise stated.

3.0 CHARACTERISTICS

3.1 Performance

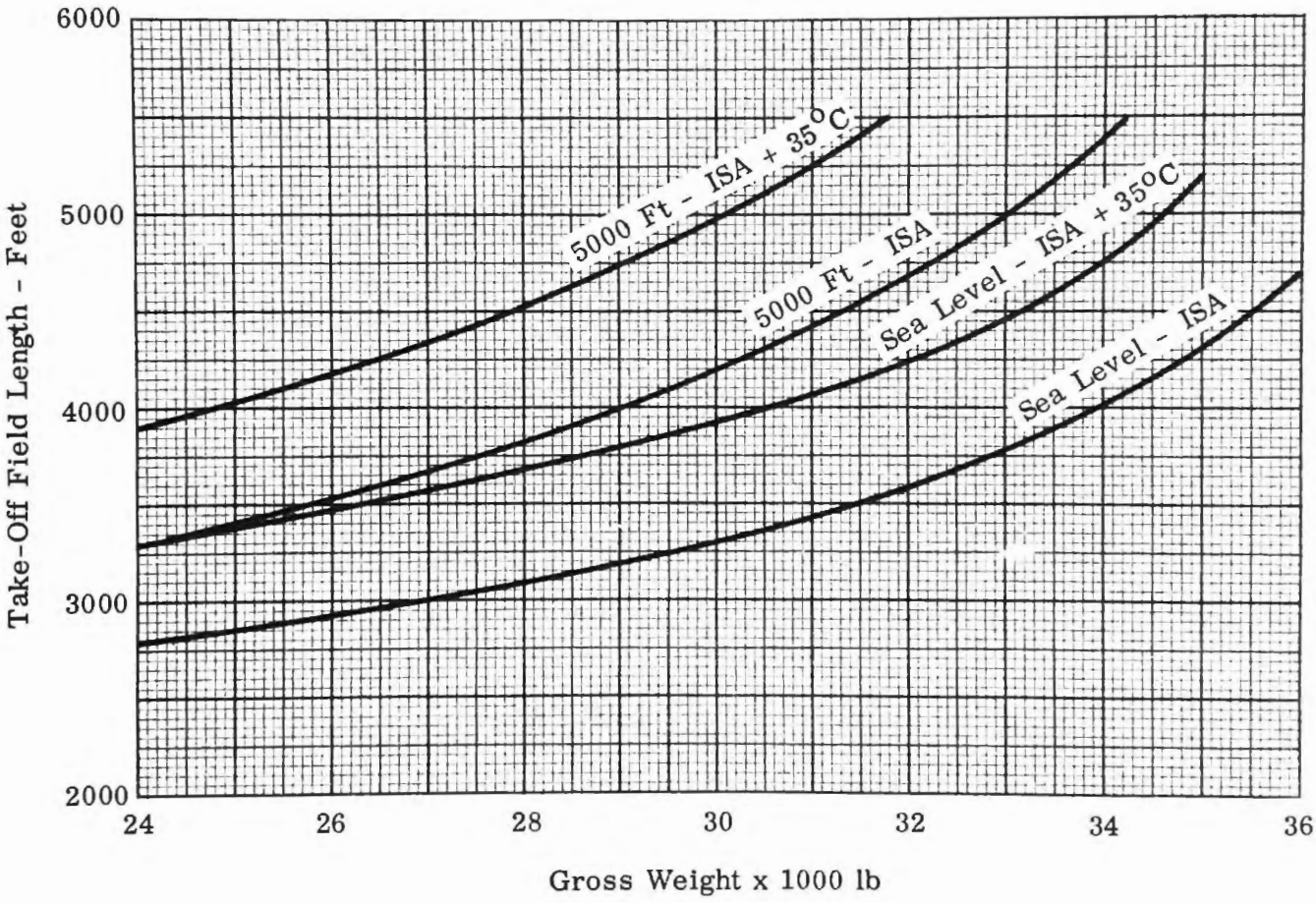
3.1.1

Performance	Demonstration Gross Wt. Lbs.		
Cruising True Airspeed at 25,000 feet with 14,200 engine RPM & 770°C TGT	27,500		357 MPH 310 Knots
Theoretical maximum range at 25,000 feet altitude with 10,400 lbs. of fuel from an initial weight of 36,000 lbs. at the noted cruise power derived from miles per pound of fuel demonstrated at two gross weights at a constant altitude and including unburned fuel reserve of 500 lbs.	27,500 & 29,500	14,200RPM-770°C TGT	2,422 Stat. Miles 2,105 Naut. Miles
		14,200RPM-730°C TGT	2,610 Stat. Miles 2,265 Naut. Miles
F.A.A. Take-off airport length at sea level under standard day conditions, CAR SR-422A-4T.113.	36,000		4,720 ft.
F.A.A. Landing airport length at sea level under standard day conditions, CAR SR-422A.	34,285		2,740 ft. (4T.122) 4,540 ft. (40T.84)

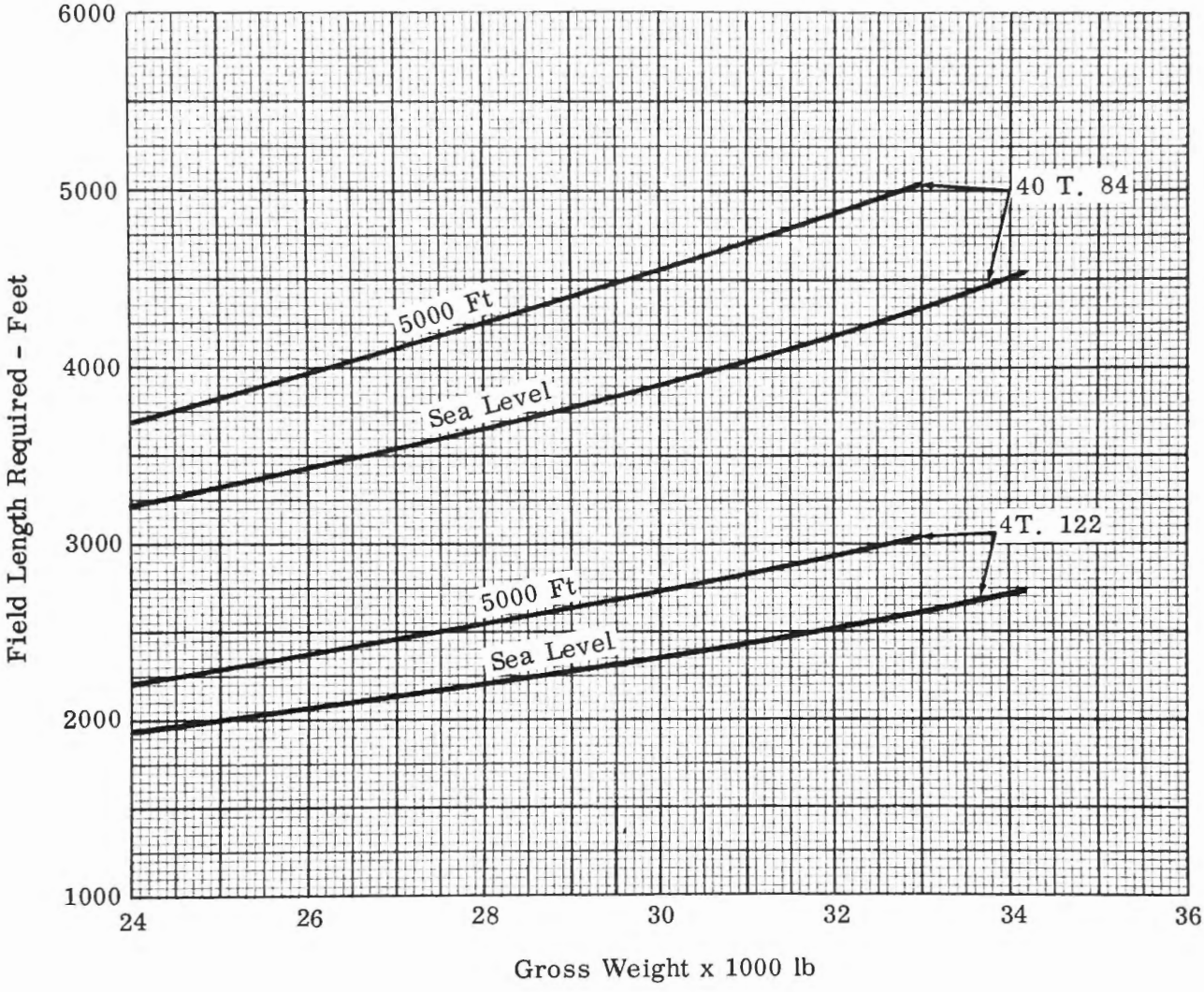
3.1.2 Airplane Configuration. - Performance data herein are based upon the equipped airplane with the installation of antennas, pitot heads, windshield wipers, and anti-collision lights, on I.S.A. standard day (except as otherwise required by CAR), with automatic propeller feathering for take-off.

3.1.3 Conditions. - All performance estimates are for I.S.A. conditions. Performance is contingent upon nominal power and fuel consumption specified in the engine manufacturer's specification including the definition of maximum cruise power and with Kerosene ASTM D.1655-61.T (Type A or A-1) at 6.75 pounds per gallon and heating value of 18,600 BTU's per pound. A normal total gearbox accessory power extraction of 100 SHP is assumed. Engine power shall be determined in flight by the use of torquemeters or other accurate calibrating devices. Fuel consumption in flight shall be determined by the use of flowmeters. A hard surface level runway, zero wind, and the most favorable use of brakes, flaps, landing gear, power, and ground idle thrust apply for take-off and landing guarantees.

Take-Off Field Length
(Ref: C. A. R. -SR-422A 4T. 114 Through . 117)

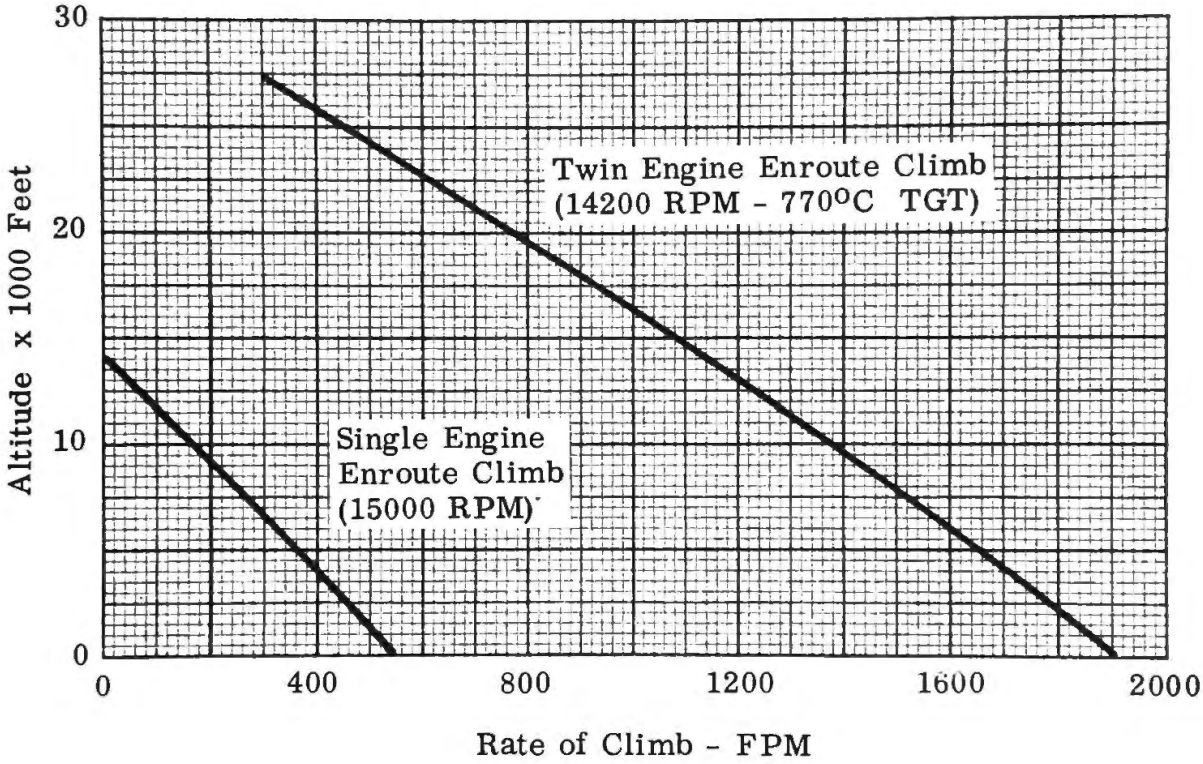


Landing Field Length
(Ref C. A. R. - SR-422A)



Rate of Climb vs Altitude

Take-Off Weight 36000 lb

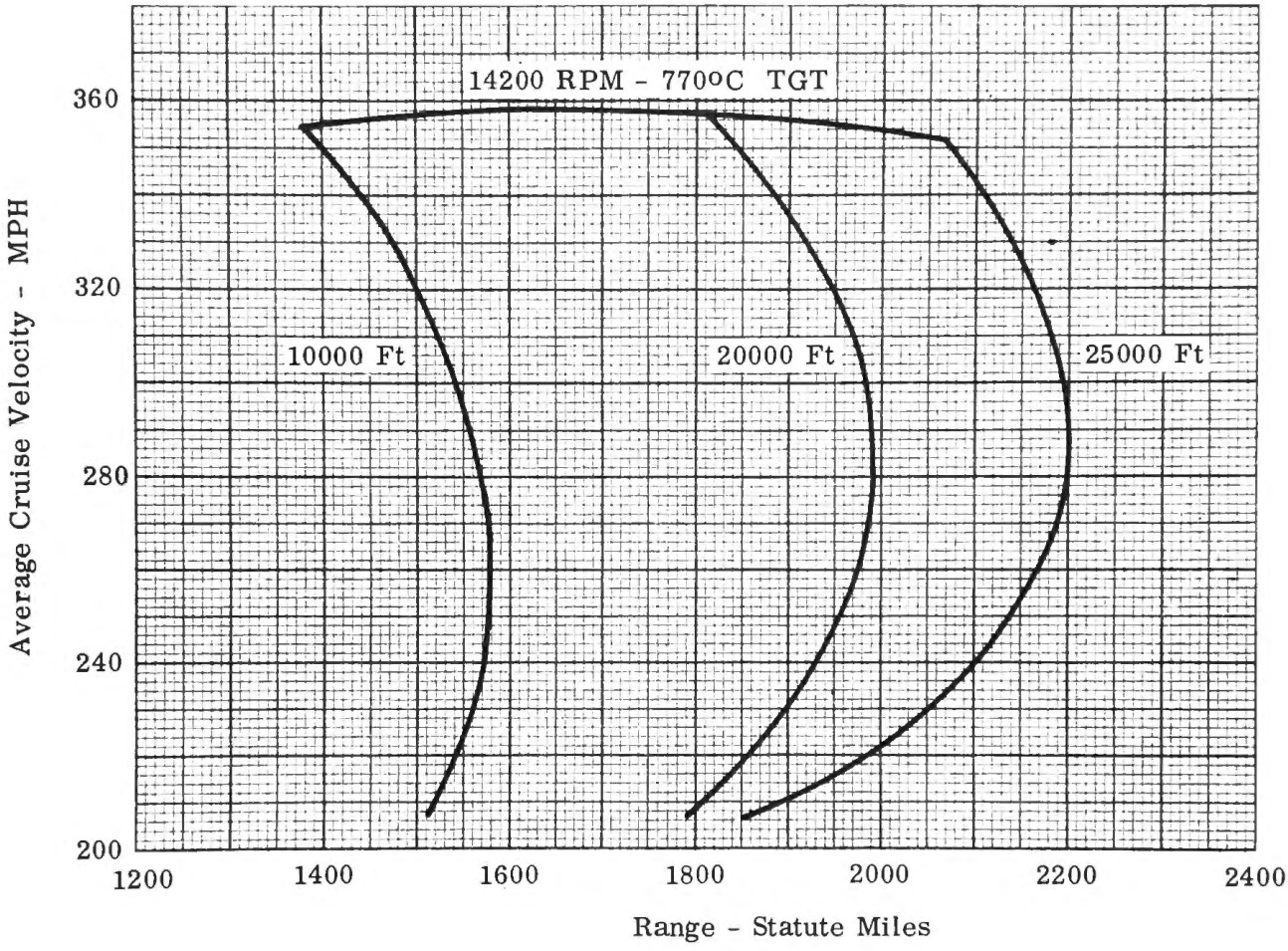


Cruise Performance

T.O. Weight: 36000 lb

T.O. Fuel: 10,462 lb

Note: Reserve Fuel for
3/4 Hr Hold @ 20,000 Ft
200 St Mi Diversion @ 20,000 Ft @ Speed for Max Range

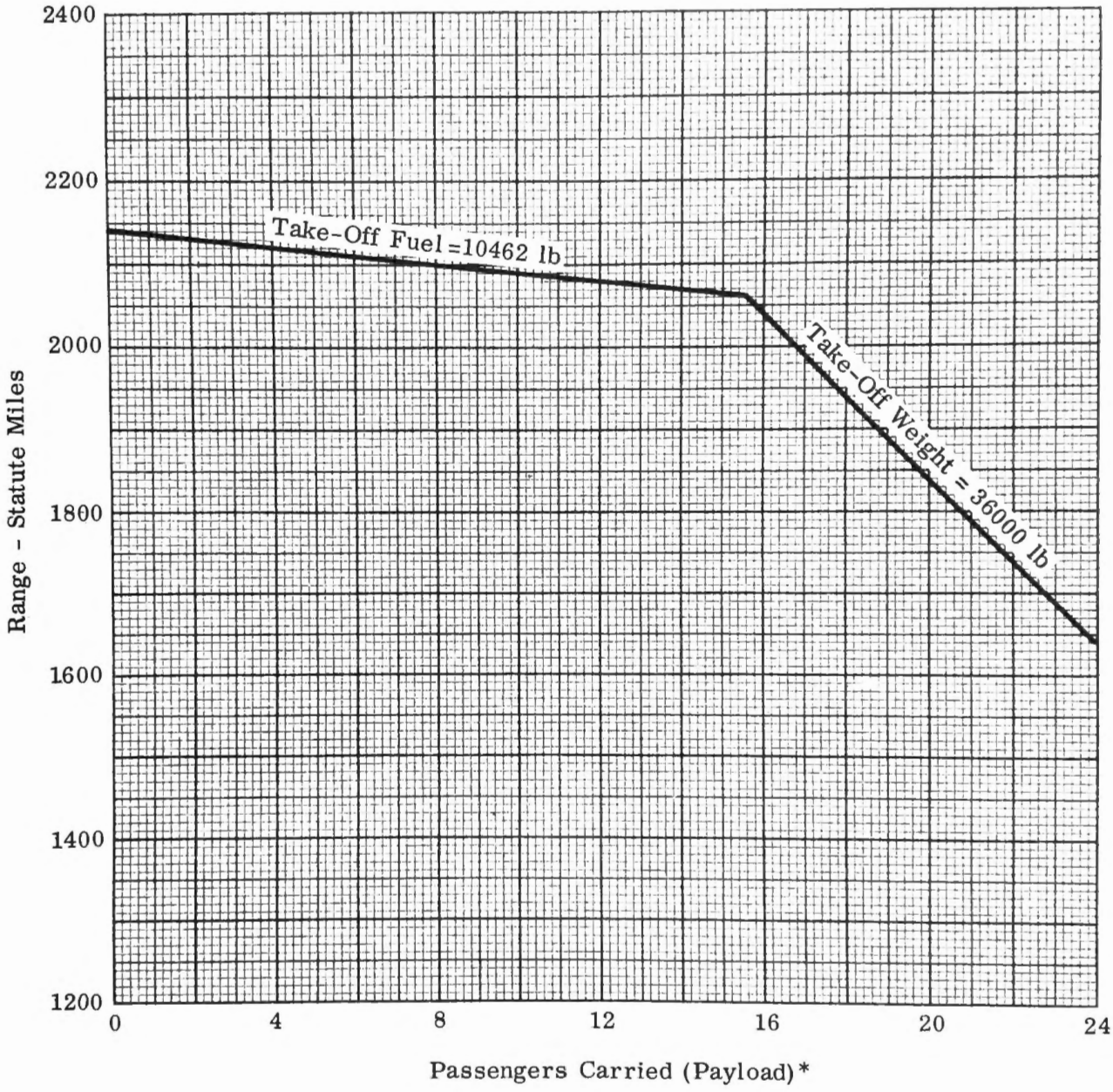


Range-Payload at 25000 Ft
14200 RPM 770°C TGT

Note: Reserve Fuel for

1 3/4 Hr Hold @ 20,000 Ft

2 200 St Mi Diversion @ 20,000 Ft @ Speed for Max Range



*1 Passenger = 200 lb (170 lb + 30 lb Baggage)

Rev. F Sept 1, 1965

3.2 Airplane Weight Summary

3.2.1 Grumman Weight Empty (Bare Weight). - This is the weight empty of the unfurnished Gulfstream airplane, without ferry kits, as delivered by Grumman. Subject to specification amendments and variations in actual weight from weight allowed for purchased equipment, this weight is 18,733 pounds.

3.2.1.1 Grumman Weight Empty (Bare Weight) abridged Group Weight Statement:

Group		Weight	
Wing			3680
Tail			875
Body			3657
Alighting Gear			1271
Surface Controls			498
Nacelle			1100
Propulsion			4580
	Engine Installation	2744	
	Accessory Gearbox	223	
	Exhaust System	205	
	Fuel System	150	
	Water/Methanol System	112	
	Engine Controls	101	
	Starting System	43	
	Propeller Installation	1002	
Auxiliary Power Plant			346
Instruments			111
Hydraulic			240
Electrical			1024
Electronics			99
Furnishings and Equipment			436
Air Conditioning & Anti-Icing			810
Auxiliary Gear			6
Total - Grumman Weight Empty (Bare Weight)			18733

3.2.2 Outfitting Allowance. - This is an estimated weight allowance for a representative outfitting of the Grumman delivered Gulfstream. It is used in deriving a typical loading summary for a finished airplane.

Items	Weight	
Exterior Finish		94
Wings	30	
Tail	15	
Body	39	
Nacelles	10	
Autopilot/Flight Director		140
Flight Instruments		124
Dual Gyro Compass	76	
Autopilot & V.H.F. Navigation Associated	21	
Others	27	
Electrical		60
Warning Lights	3	
Exit Inertia Lights	9	
Galley, Cabin and Lavatory Power and Lighting	48	

3.2.2 Outfitting Allowance. - (Cont.)

Items		Weight	
Electronics			521
Dual V.H.F. Communication System		81	
Dual V.H.F. Navigation and Glide Slope System		93	
Dual A.D.F. System		63	
Dual Amplifier Intercom/PA System		57	
Single Marker Beacon System		9	
Single Weather Radar System		73	
Single D.M.E. System		48	
Single A.T.C. System		37	
Forward Equipment Rack		36	
Aft Equipment Rack		24	
Furnishings and Equipment			1585
Accommodations for Personnel		843	
Jump Seat Installation	35		
Three-Place Divan	90		
Swivel Single Seats (Five)	225		
Fixed Double Seats (Two)	130		
Lavatory	120		
Galley	140		
Tables, Desk, Bar	84		
Oxygen System	19		
Miscellaneous Equipment		31	
Flight Instrument Panels	5		
159GT1049 Tow Bar and Mounting Bracket	26		
Furnishings		666	
Floor and Outlet Duct Covering	100		
Soundproofing and Insulation	233		
Trim	164		
Curtains and Screens	40		
Partitions and Doors	129		
Emergency Equipment		45	
Cabin Fire Extinguisher and Bracket	8		
Baggage Compartment Smoke Detection	5		
First Aid Kit	15		
Flashlights	4		
Crash Axe Installation	3		
Portable Oxygen Bottle, Mask and Bracket	10		
Air Conditioning			10
Fresh Air System Installation		10	
Total Outfitting Allowance			2534

3.2.3 Furnished Weight Empty. - This is the sum of Grumman Weight Empty (Bare Weight) and the Outfitting (Allowance) Weight:

Grumman Weight Empty (Bare Weight)	18733
Outfitting Allowance Weight	2534
Total Furnished Weight Empty	21267

3.2.4 Typical Loading Summary-Full Development

Item		Weight	
Furnished Weight Empty			21267
Fixed Operating Items			212
Full Engine and Propeller Oil		113	
Unusable Fuel		72	
Unusable Water/Methanol		27	
Empty Weight			21479
Useful Load			14521
Operating Items (Operating Weight is 22308)		829	
Pilot and Copilot	340		
Flight Engineer/Attendant	170		
Crew Baggage @ 30 lbs.	90		
Navigation Kit and Flight Manual	30		
Wash Water and Lavatory Supplies	30		
Galley and Bar Commissary	169		
Payload (Zero Fuel and Water/Methanol Weight is 25408)		3100	
Eleven Passengers	1870		
Passenger Baggage @ 30 lbs.	330		
NOTE: Increase gross weight effective September 1, 1965	900		
Usable Fuel and Water/Methanol		10592	
Fuel (Capacity 10462 lbs.)	10462		
Water/Methanol (Capacity 372 lbs.)	130		
Take-off Weight			36000

3.3 Aerodynamic Characteristics

3.3.1 Permissible Center-of-Gravity Limits. - The following tables describe the weight/center of gravity envelope of the airplane in terms of percent of the mean geometric chord. Variation is linear between the points shown.

Clean Configuration-Gear & Flaps Retracted

Weight	Forward Limit	Aft Limit
21000	13.0	26.9
24000	13.0	--
26100	--	29.0
34285	20.1	31.1

Take-off and Landing Configuration-Gear & Flaps Extended

Weight	Forward Limit	Aft Limit
21000	14.3	28.6
23700	14.3	--
26100	--	30.4
34285	21.2	32.2
36000	22.3	32.6

3.3.1.1 Center-of-gravity range for flight shall be sufficient to allow crew and passenger movement and landing gear retraction as specified by CAR (See page 15).

3.3.2 Control. - The airplane shall be positively controllable at angles of attack at least up to that of maximum lift and at no point, even at angles beyond that of maximum lift, shall there be any sudden auto-rotative tendencies, loss of stability, or loss of control.

3.4 Design Criteria

3.4.1 General. - Design criteria shall be based upon the CAR requirements designated in paragraph 2.2, sub-para. 2.2.1 and shall be as follows:

3.4.2 Maximum Weight, Design Maximum Weight, Design Take-off Weight. - The demonstrated and structural design gross weight which fulfills the above requirements as defined in CAR 4b.1(c) is 36,000 pounds.

3.4.3 Design Landing Weight. - The structural design gross weight which fulfills the above requirements as defined in CAR 4b.1(c) is 34,285 pounds.

3.4.4 Design Minimum Weight with Reserve Fuel. - The structural design minimum gross weight, including an assumed minimum usable fuel load (45 minutes reserve), is 21496 pounds.

3.4.4.1 Zero Fuel Weight. - The structural design maximum gross weight of the airplane with no disposable fuel, and water/methanol (which, because of its location in the wings is treated as a fuel load), and oil is 27303 pounds. This weight plus 67 pounds of usable oil (full oil) is 27370 pounds.

3.4.4.2 Design Maximum Weight with Reserve Fuel. - The structural design maximum gross weight, including an assumed minimum usable fuel load (45 minutes reserve) is 28,216 pounds; which is comprised of the zero fuel weight plus usable oil weight plus reserve fuel weight.

3.4.5 Limit Flight Load Factors. - The airplane shall be designed by either gust or maneuver load factors, whichever is more critical at any particular gross weight.

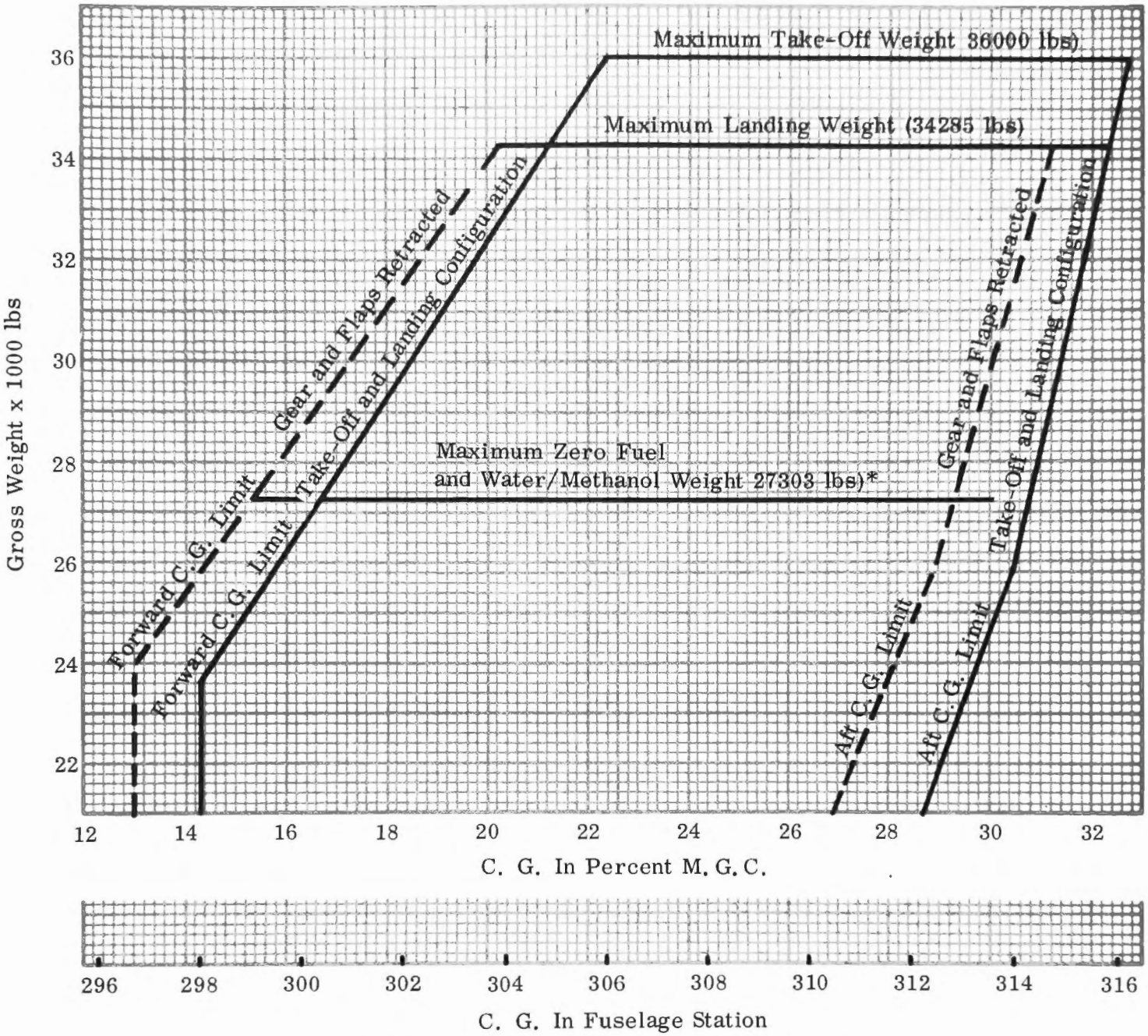
3.4.6 Limit Loading Load Factors

3.4.5.1 At the landing structural design weight of 34,285 pounds, the airplane shall be designed for the load factors resulting from ground contact at a vertical descent velocity of 10 feet per second.

3.4.6.2 At the maximum gross take-off weight of 36,000 pounds, the airplane shall be designed for the load factors resulting from ground contact at a vertical descent velocity of 6 feet per second.

3.4.7 Limit Speeds

Gross Weight C. G. Envelope



* Maximum Zero Fuel and Water/Methanol Weight Plus 67 Lbs "Usable" Oil, (Full Tanks) is 27370 Lbs. For Gulfstreams with Outer Wing Panel Fuel Installation, 27370 Lbs. is the Maximum Zero Fuel Weight (Water/Methanol Loaded).

3.4.7.1 Limit Speeds. - (See the Curve on page 17).

Design: (demonstrated)	M_D = .675 above 15,200 ft.	
	V_D = 341.5 kts. I.A.S. below 15,000 ft.	
Placard:	$M_{MO} = M_C$ = .54 above 15,000 ft.	
	$V_{MO} = V_C$ = 290 kts. I.A.S. below 15,000 ft.	
	In turbulent air V_C = 200 kts. I.A.S.	

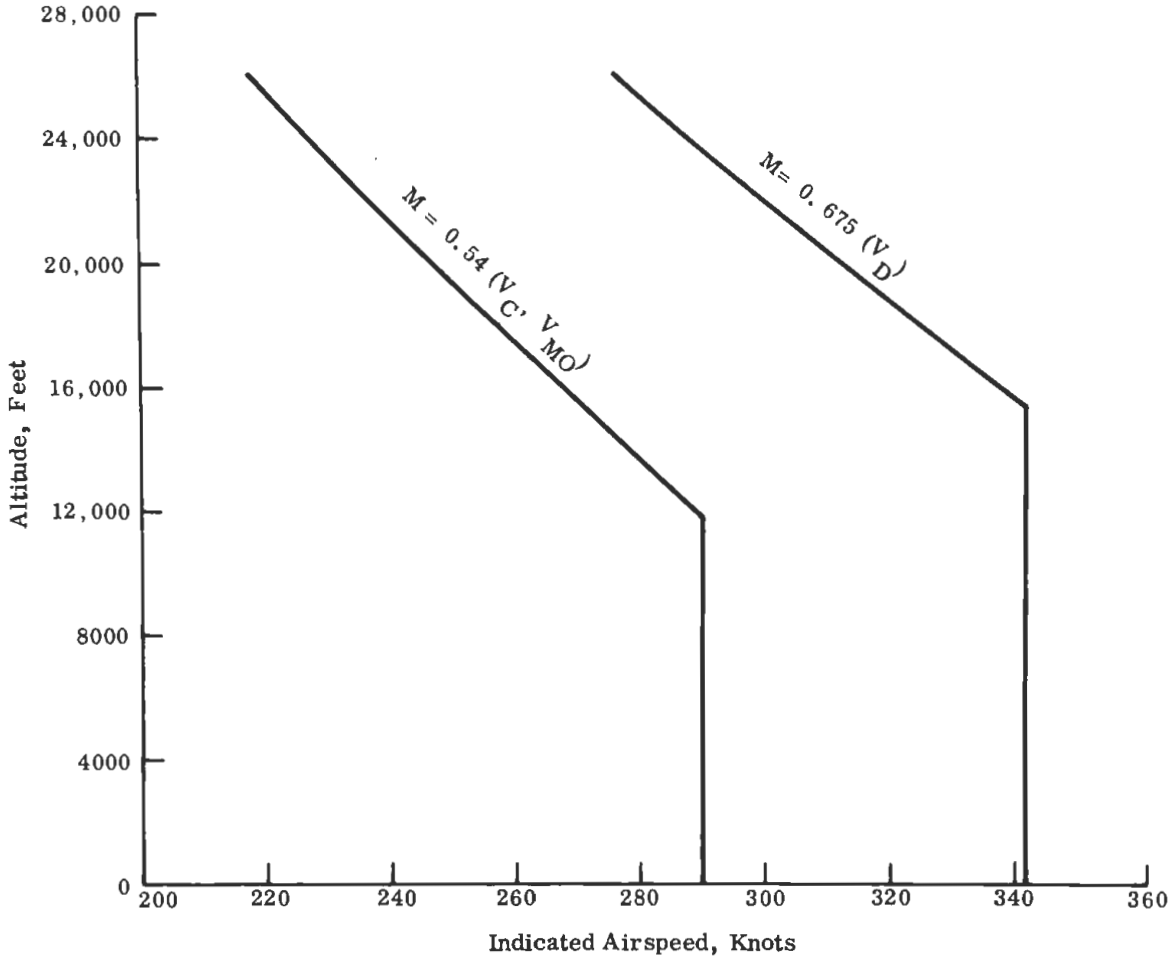
3.4.7.2 Limit Extension and Retraction Speeds. -

Wing Flaps:	To landing position,	143 knots I.A.S.
	To take-off position,	219 knots I.A.S.
Speed Brakes:	(Main Landing Gear) Extension	310 knots I.A.S.
Landing Gear:	(Main & Nose Gear)	193 knots I.A.S.

3.4.8 Pressurized Fuselage. - The fuselage shall provide for pressurizing the compartments for the crew, passengers, and cargo to a maximum differential pressure of 7.2 pounds per square inch (sea level cabin altitude at approximately 15,000 feet). Each fuselage shall be tested on the ground prior to delivery to demonstrate that the fuselage leakage rate, exclusive of venturis, is equal to or less than 158 standard cubic feet per minute at 6.55 psi pressure differential.

3.5 Dimensions and General Data. -

Wings:	
Span, maximum	78.33'
Chord:	
At root (centerline of aircraft)	134"
At construction tip (theoretical extended section at tip)	53"
Mean geometric	99.35"
Section and thickness (per cent chord):	
At root (centerline of aircraft)	63A214
At consturction tip (theoretical extended section at tip)	63A314
Incidence	
At construction tip	0°
At root	+3°
Sweepback of leading edge	4° 15'
Dihedral	6° 30'
Aspect ratio	10
Ailerons:	
Span	153"
Chord (average per cent wing chord) (aft of hinge line)	25.5%
High lift device:	
Type, flaps	Single slotted
Span, exclusive of cut-outs (percent of wing span)	57%
Chord, (average percent wing chord)	29%



Design Speeds vs Altitude

3.5 Dimensions and General Data. - (Cont.)

Tail:	
Horizontal:	
Span	306"
Chord (MGC)	64.25"
Section and thickness	
At root	63A212 (Inverted)
At tip	63A212 (Camber)
Incidence, normal	0°
Dihedral	6°30'
Aspect ratio	4.81
Vertical fin (center):	
Section and thickness	
At root	63A012
At tip	63A012
Height over highest fixed part of aircraft: (at normal Gross Weight)	23.33'
Length, maximum (static ground line)	63.75'
Ground angle (static)	0°45'
Propeller, number of blades (4)	
True diameter	11'-6"
Clearance:	
To ground (normal attitude)	18.5"
To fuselage	30.0"
Wheel size:	
Main wheels (dual)	7.50 x 14
Nose wheels (dual)	6.50 x 8
Tire and tube size:	
Main wheels (dual) Type III	7.50 x 14
Nose wheels (dual) Type III	6.50 x 8
Tread of main wheels	290"
Vertical travel of axle from extended to fully compressed strut positions:	
Main wheels	12"
Nose wheels	9"
Angle between lines joining center-of-gravity with points of ground contact centered between the main wheel tires, static deflection of 1W (front elevation)	119°
Angle of line through the most aft center-of-gravity and ground contact of main wheel to vertical line, reference line level, static deflection of 1W (side elevation)	11°30'

3.5.1 Areas. - The principal areas are as follows:

Wing area, projected, including area through fuselage	610.3 sq. ft.
Aileron 18.5 ft.^{2} (aft of hinge)	37 sq. ft.
Flap 55.6 ft.^{2} (per side)	111.2 sq. ft

3.5.1 Areas. - (Cont.)

Horizontal tail area, total	136	sq. ft.
Stabilizer	98.76	sq. ft.
Elevators each (aft of hinge)	17.50	sq. ft.
Vertical tail area, total	117.1	sq. ft.
Fin	88.4	sq. ft.
Rudder (aft of hinge line)	28.7	sq. ft.

3.5.2 Control Surface and Corresponding Control Movements. - Control surface and control movements on each side of neutral position for full movement as limited by stops are as follows:

Wing flap	33°
Rudder	± 22°
Rudder pedals	± 4"
Elevators	25° up, 14° down
Elevator control	5" fwd., 8" aft.
Aileron	16° up, 12° down
Aileron control	± 90° at wheel
Aileron trim tab	± 20°
Rudder spring-trim	± 10°
Elevator trim tab	Nose 20° up 3° down
Aileron spring tab	± 15°

4.0 STRUCTURAL DESIGN CRITERIA

4.1 General. - The airplane structure in general shall be fabricated from aluminum alloy. Alloy steels, stainless steels and titanium shall be used where advantageous to strength, endurance, weight, or heat protection. Means shall be provided for drainage at points in the structure where liquids and/or condensation may collect. Protection against structural fatigue shall be a serious consideration throughout the structural design. Proper attention shall be given to stress levels, the provision of adequate radii, surface finish, corrosion protection, and minimize discontinuities.

4.1.1 Strength Requirements.

Basic flight design gross weight	36,000 lbs.
Basic landing design gross weight	34,285 lbs.
Basic take-off design gross weight	36,000 lbs.
Positive maneuver limit load factor at basic flight design gross weight	2.5
Limit sinking speed	10 ft./sec.

4.1.2 Detail Strength Requirements. - Strength and rigidity shall meet the applicable requirements of CAR 4b for the airplane with the Dart Mark 529-8X engine installed.

4.1.3 Structure Exposed to Airstream. - Engine cowls, other cowlings or fairings, windshields, cockpit enclosures, and other items of structure or equipment exposed to the airstream and having special aerodynamic characteristics, shall be designed for all combinations of pressure for the airplane combined with conservative assumptions with respect to coincident vibratory loads or stresses.

4.1.4 Structural Fasteners. - Structural fasteners such as bolts, nuts, washers, rivets and others shall, wherever possible, be AN, NAS MS or Grumman Standard parts.

4.1.5 Attachments. - All locations on control surfaces, including tabs and flaps, and their supporting structure which involve single bolted or pinned attachments shall incorporate replaceable bearings or fittings.

4.1.6 Blind Attachments. - All blind bolted attachments shall incorporate gang channel nuts or anchor nuts suitably fixed to the blind structure.

4.2 Wing Group

4.2.1 General Description. - The wings shall be all metal, full cantilever construction and consist of a center section, which shall include engine nacelles, wing flaps, integral fuel tanks, and supporting structure for the main landing gear, an outer panel including water/methanol tanks, ailerons and landing lights.

4.2.2 Construction. - The basic structure of the wings shall consist of a box beam comprised of two beams and upper and lower surfaces of machined, integrally stiffened aluminum alloy. Ribs shall be provided to stabilize the structure and maintain contour.

4.2.2.1 Access Panels. - Access panels or doors shall be provided in the wing structure so located as to provide access to the wing interior for inspection, maintenance and repair.

4.2.2.2 Wing Tips. - Replaceable wing tips shall be provided to facilitate wing repair. Wing tips shall absorb the shock of minor ground collisions by yielding under load so far as practicable and still meet F.A.A. strength requirements.

4.2.2.3 Ailerons. - The ailerons consist of the aileron panels with attached fittings, trimming tabs and control horns, complete and ready for attachment of flight controls. Aileron movement on either side of the neutral position shall be such that satisfactory control will result for all normal operations and specified maneuvers of the airplane. Sufficient additional movement of the aileron shall be provided so that the limit of movement may be controlled by stops rather than by jamming the hinges or control surfaces proper. Outboard hinges of ailerons shall not be located in removable wing tip sections.

4.2.2.4 Leading Edge Construction. - The wing leading edges are removable and shall consist of aluminum alloy skin, ribs, and structure for attachment to the wing front spar and shall incorporate pneumatic boots for ice elimination. They shall be fabricated so as to minimize denting or other damage which might result from flight through hail or from ground operation.

4.2.3 Fuel Tank Sealing. - The wing structure, within the confines of the integral fuel tanks, shall incorporate such design principles and features as to ensure that mechanical sealing, in combination with the use of appropriate sealing compounds, will provide optimum service. A cutaway of a wing tank section is shown on page 22.

4.2.4 Wing Flaps. - High lift flaps of aluminum alloy shall be provided on the trailing edge from fuselage to the ailerons. Flap tracks shall be of steel and shall not extend beyond the wing contour. The flaps shall be mechanically synchronized.

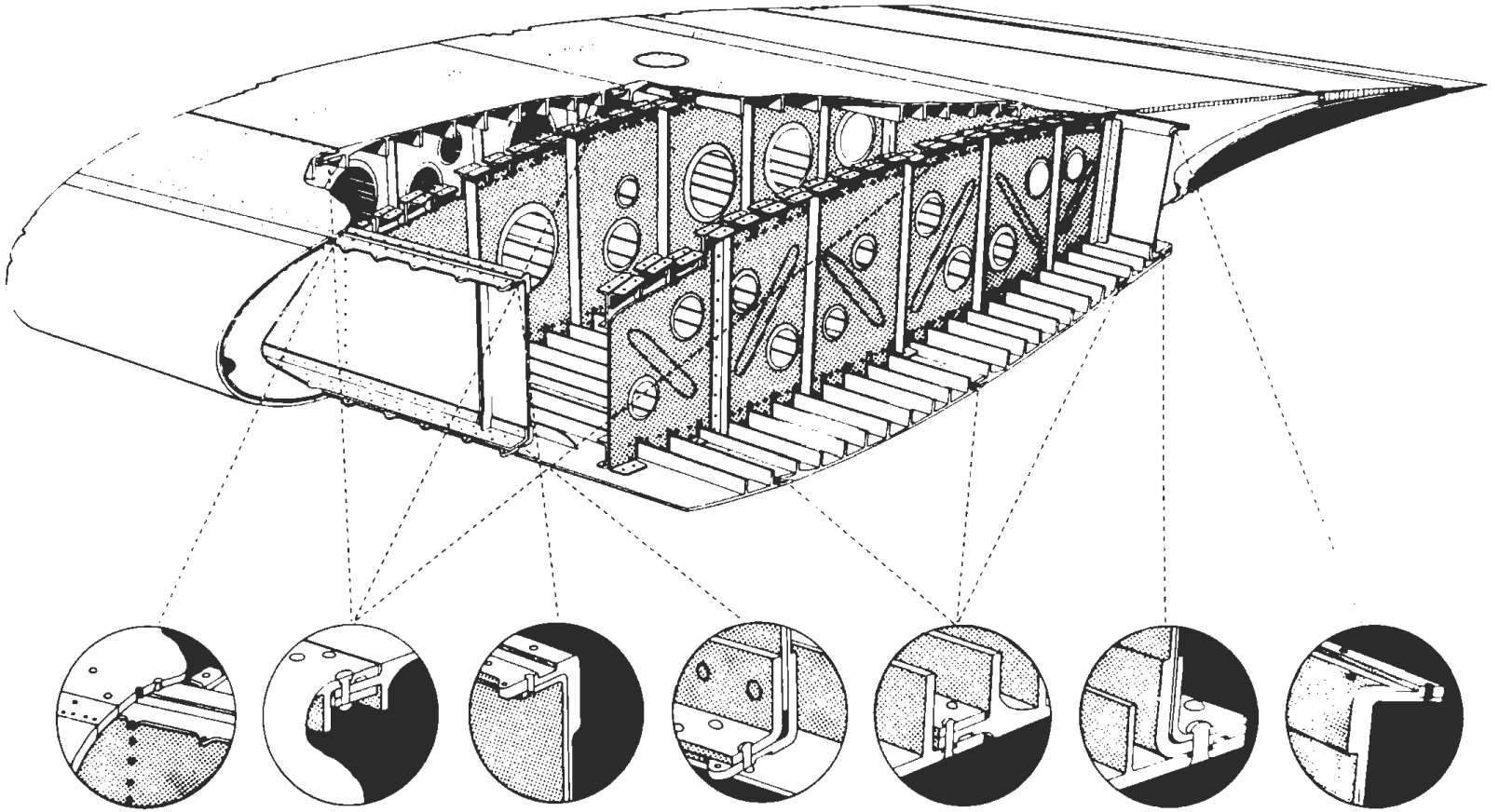
4.3 Anti-Chafe Provisions

4.3.1 Wing Flap. - Means shall be provided to protect the wing flap skin and the wing trailing edge structure from wear due to chafing when the flaps are in the fully-retracted position.

4.4 Tail Group

4.4.1 Description. - The tail group shall consist of vertical stabilizer and rudder, horizontal stabilizer and elevator and trim tabs. All components shall be of aluminum alloy except for the hinge fittings which shall be of steel.

Fuel Tank Design Permits Any Leak to be Repaired from the Outside with Minimum Effort



Non-Curing Thiokol-Rubber Injected Under Pressure into Channel Seal Groove

Typical Wing Section Showing Fuel Tank

4.4.2 Stabilizer. - The stabilizer consists of fixed panels complete with attachments.

4.4.3 Elevators. - Elevators shall consist of panels with attached fittings, trimming surfaces, control horns and fastenings ready for attachment to the stabilizer and for attachment of flight controls.

4.4.4 Fin. - The fin shall be constructed as a unit bolted onto the fuselage.

4.4.5 Rudder. - The rudder shall consist of a panel with attached fittings, trimming surfaces, attached levers, control horn and fastenings ready for attachment to the fin and flight controls.

4.4.6 Elevator and Rudder Stops. - Sufficient additional movement of the elevator and rudder shall be provided so that the limit of movement may be controlled by stops rather than by jamming the hinges or control surfaces proper.

4.4.7 Leading Edge Construction. - The vertical and horizontal stabilizer leading edges shall consist of aluminum alloy skin and structure for attachment to their respective stabilizer front spars, shall incorporate pneumatic boots for ice elimination and shall be constructed so as to minimize denting or other damage which might result from flight through hail. The attachment of the leading edge shall be such that the leading edge structure shall be attached directly to the stabilizer spar rails.

4.4.8 Access Doors. - Doors shall be provided in the vertical and horizontal stabilizer structure to provide access to the stabilizer interior for inspection.

4.4.9 Deicing. - The wing and the stabilizers shall be provided with Goodrich high pressure, flush-type boots.

4.5 Body Group

4.5.1 General. - The body group shall consist of the fuselage structure and all provisions for the attachment of the wing, tail group, and nose landing gear assembly.

4.5.2 Construction. - The fuselage shall be of semi-monocoque construction using skin, stringer, and circumferential ring combination. The fuselage shall be pressurized between the bulkhead forward of the flight station and the bulkhead aft of the baggage compartment. The construction of the fuselage shall meet the applicable C.A.R. requirements. In the propeller area the fuselage shell shall be suitably modified to prevent damage from pressure pulses or ice thrown by the propeller blades.

4.5.3 Cockpit and Cabin Enclosures. - Cockpit and cabin enclosures shall be watertight when the airplane is at rest or in flight. The windshield shall be free to expand and contract with changes in temperature and aging without distorting the structure or impairing the efficiency of the joints. The combination of transparent materials and support frames shall be sufficiently rigid to withstand all probable loads imposed in the transparent elements of the cockpit and cabin enclosures.

4.5.4 Windshield and Direct Vision (DV) Windows. - A windshield and DV windows shall be provided for the cockpit enclosure. They shall safely withstand the airloads imposed by flight requirements specified for the airplane and for required bird loads. Laminated electrically heated anti-icing glass shall be used.

4.5.5 Vision. - The maximum practicable vision shall be provided for the pilots. Angles-of-incidence shall be employed, consistent with aerodynamic, structural, and fabricating considerations, which will result in the least possible optical distortion in the transparent components, and prevent reflection of objects both within and without the cockpit from interfering with pilot's vision. Windshield wipers and direct vision windows shall be provided to insure visibility in heavy rain for taxiing, take-off, approach and landing.

4.5.6 Windshield and Windows. - Windows shall be watertight and mounted so that they may be replaced without mutilation of the airplane skin and so that they will not fail due to applied loads, distortion, or vibration of the airplane in service. All glass windows shall be of a fail-safe design. Each cabin window shall have two plates of plexiglass of equal thickness. The cockpit side windows shall be laminated,electrically heated defogging glass. The electrical controls for the side windows shall be optional equipment.

4.5.7 Passenger Compartment. - The airplane shall be delivered by G.A.E.C. to the distributor structurally complete less interior furnishings.

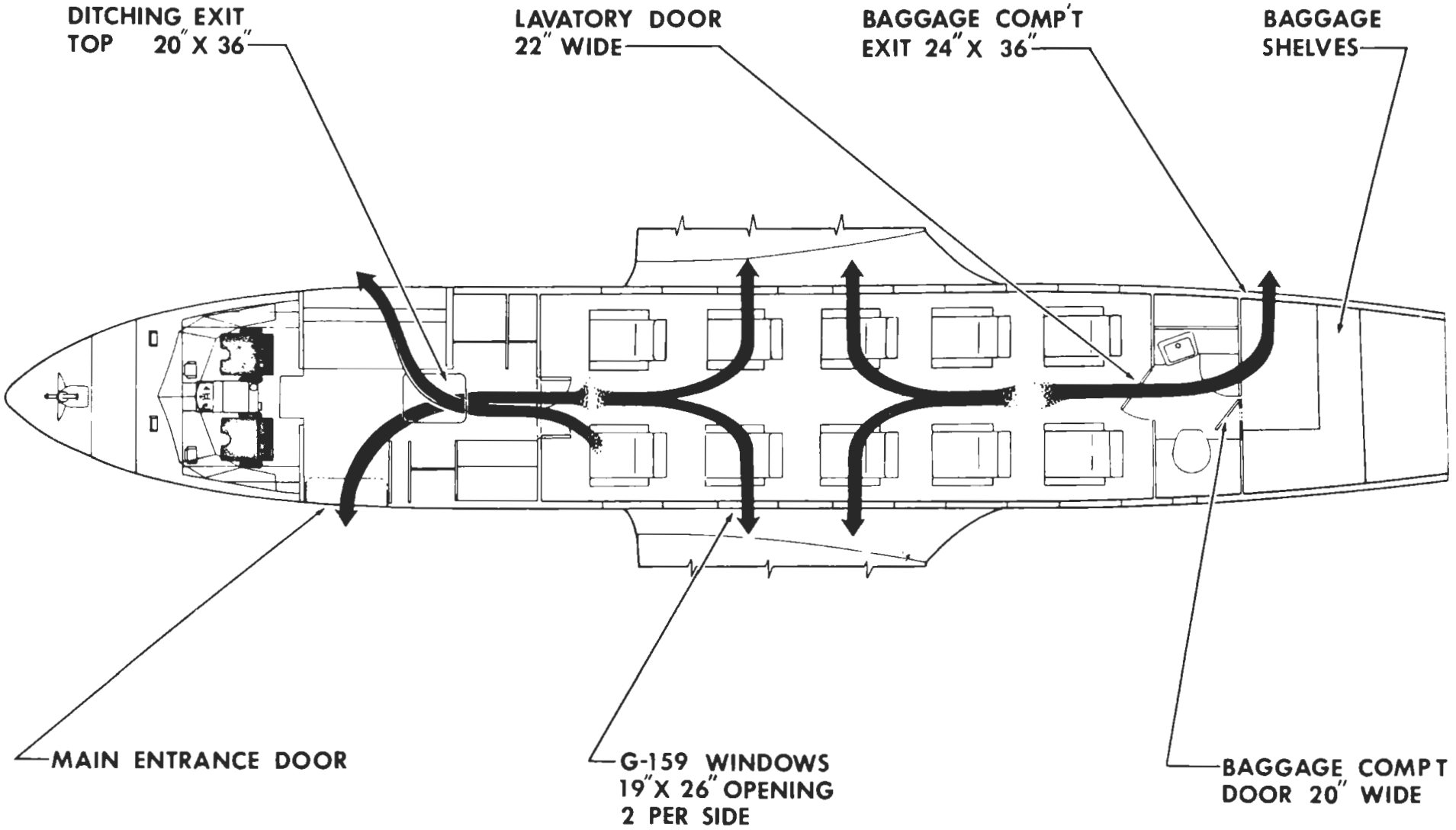
4.5.8 Equipment Compartment. - Space shall be provided for the combination of electronic and navigational equipment selected.

4.5.9 Doors. - All external doors shall be so constructed that maximum watertight integrity will be maintained when exposed to forces resulting from ditching of the airplane. All doors shall be provided with a seal to prevent entrance of sand, dirt, or spray. Spring action shall not be used to return the latch to the locked position, but may be used to hold the latch in the locked position and resist vibrational forces tending to unlock the door. The handles shall provide a positive "feel" and their position shall be a direct indication of the position of the latch mechanism.

4.5.9.1 Main Entrance Door. - The door shall be opened and closed hydraulically and a self-contained stairway shall eliminate the need for ground handling facilities. The door is manually operable in the event of hydraulic failure.

4.5.10 Emergency Escape. - Escapes shall be provided to permit ready and safe exit of the passengers and crew in an emergency. There are seven available emergency exits as follows:

(1) Four removable plug-type windows in the main cabin
(2) The baggage compartment door
(3) The main entrance door
(4) A plug-type overhead exit aft of the cockpit (Ditching Exit)



EMERGENCY ESCAPE PROVISIONS

4.5.10 (Cont.)

In addition, the direct vision cockpit windows, although not fully qualified as emergency exits, can be used for emergency escape. The main entrance door and the rear baggage compartment door are hinged but are not jettisonable. All escape doors or windows shall be marked and identified and provided with automatic emergency lights. The escape provisions are shown on page 25.

4.5.11 Flooring. - The cabin flooring shall be constructed of honeycomb aluminum sandwich and shall be removable. Fixed rails shall support the cabin flooring and constitute mounting provisions for any cabin furniture. In addition, the floor assembly and the sidewall liner shall be sealed to prevent small hardware from filtering into space beneath the floor.

4.6 Landing Gear

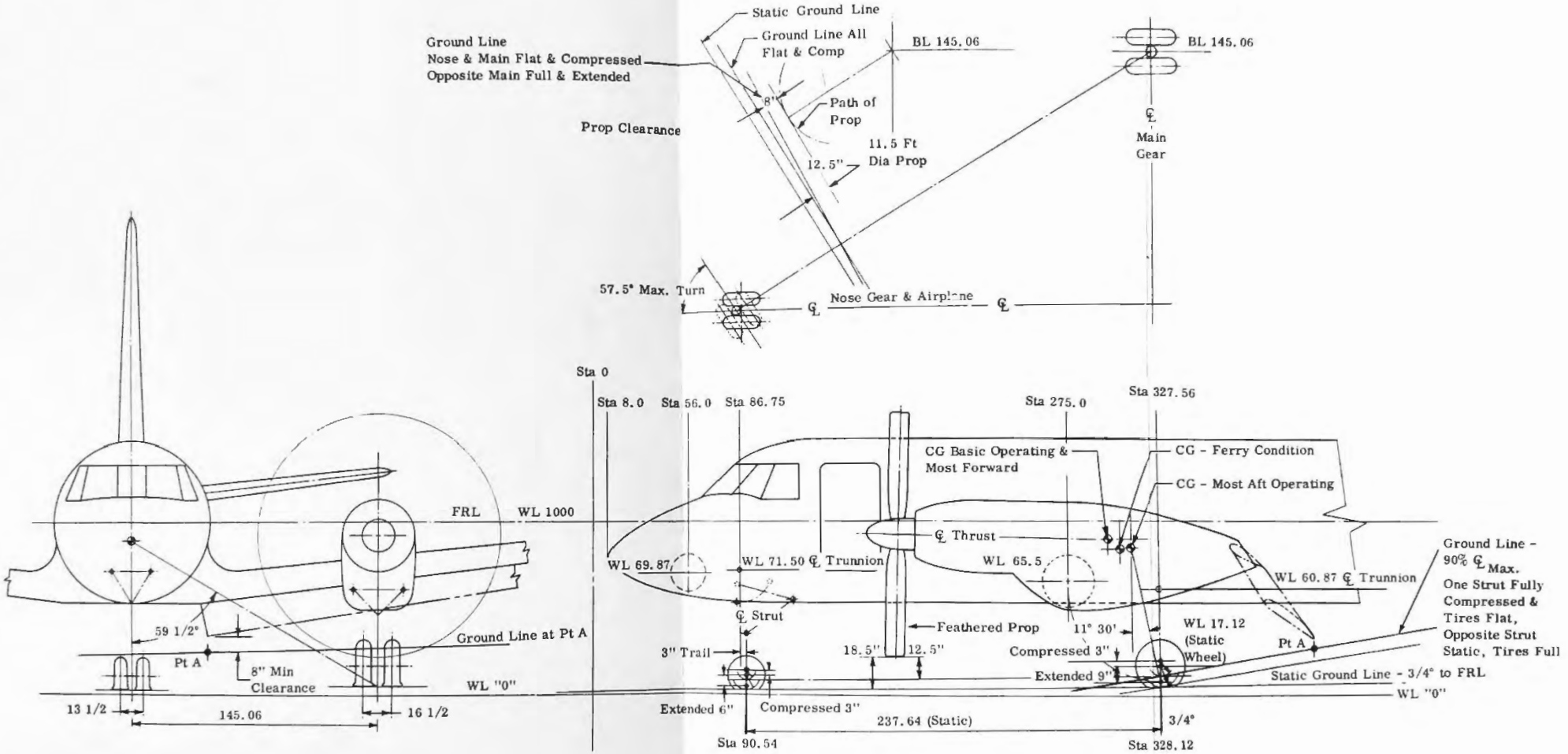
4.6.1 General Description. - The landing gear shall be of the fully retractable tricycle type. Two main gear assemblies shall be mounted on the wing within the confines of the nacelles. Each gear shall have two wheel assemblies, each mounting a tire. A dual wheel steerable nose gear assembly shall be adequate to pivot the airplane about either main gear. Hydraulic power shall be used to extend and retract the landing gear to operate the brakes and to steer the nose gear. With the torque linkage deactivated, the nose gear shall be capable of 360° rotation. Suitable uplatches shall be provided to restrain the landing gear in the retracted position. The landing gear geometry is substantially as shown on page 27.

4.6.2 Landing Gear Controls. - The extension and retraction of the landing gear shall be controlled by either lever of a dual lever system located in such a position as to be in sight as well as reach of each pilot in his normal sitting position. The control lever shall have no tendency to snap to the up position. A downlock solenoid control lock shall be provided such that the gear cannot be inadvertently retracted on the ground.

4.6.3 Emergency Extension. - In the event of hydraulic pressure failure of the landing gear actuating system, it shall be possible to lower the landing gear by gravity. Placing the emergency landing gear control lever in the down position shall release the uplatches by emergency air bottle and permit the gear to extend by its own weight and aerodynamic forces. A landing gear emergency extension handle shall be provided in the forward portion of the copilot's side console. A mechanically actuated, manually operated dump valve reset shall be provided in order to effect a return from emergency to normal operation. The reset control shall be located on the copilot's side of the center control console. All gear doors are opened by air and the nose gear is extended by air.

4.6.4 Arrangement. - Landing gear for this airplane shall be arranged as follows:

(1) Side Elevation. - With the airplane in the attitude to develop 90 per cent of the maximum wing lift and the main wheels in the static-groundline position, a horizontal line tangent to the bottom of the wheel shall not touch the lowest point of the fuselage.



Alighting Gear Arrangement

4.6.4 (Cont.)

(2) Side Elevation. - With the airplane in the three-point static-groundline condition and most aft conceivable c.g., the moment about the main wheel axle shall be such as to maintain nose wheel contact with the ground under adverse ground conditions as may occur with a ground gust load.

(3) Front Elevation. - With the airplane in the three-point static-groundline condition, the angle between the vertical centerline of the airplane and a line joining the center-of-gravity and the point of contact of either outboard wheel shall be not less than 40°.

4.6.5 Main Landing Gear. - Each main landing gear assembly shall consist of a shock strut assembly, drag strut assembly with an integral down latch, dual wheel assemblies with tires mounted and brakes, and hydraulic retraction mechanism. Wheel rotation can be stopped upon gear retraction by application of a limited amount of brake pressure.

4.6.6 Wheels. - Each main gear wheel assembly shall be 7.50 X 14 size of cast magnesium, split type construction and of such a design configuration as to lend itself well to ease of inspection. The wheel shall be suitable for mounting either conventional or tubeless tires. | F

4.6.7 Tires. - Each main tire shall be tubeless 7.50 X 14, 12 ply rating Type III.

4.6.8 Shock Absorbers. - The main landing gear shock-absorber struts shall be of the oleo-pneumatic type. They shall be mode of heat-treated steel and replaceable as a complete unit. They shall be interchangeable left and right without change of major parts. The vertical travel of the wheels during operation of the shock-absorber struts shall be sufficiently long to insure that ground loads which are based on load factors determined by drop tests will not be appreciably more critical than other loading conditions for the carry-through structure.

4.6.9 Doors and Fairings. - The leading edges of doors for retractable alighting gears shall be rigidly held in the closed position to avoid partial opening under airloads. Fairings on the alighting gear shall be readily removable and shall not interfere with moving parts of the alighting gear or brake controls for any normal position of the shock-absorber struts. The fairings shall be designed to prevent the accumulation of mud, dirt, or cinders so far as practicable.

4.6.10 Nose Landing Gear. - Each nose landing gear assembly shall consist of a shock strut assembly, drag strut assembly, trunnion assembly, dual wheel assembly with tires mounted, self-contained downlatch assembly, steering mechanism, and hydraulic retraction mechanism. Shimmy dampering shall be provided in the steering mechanism.

4.6.11 Shock Strut. - The nose gear shock strut shall be of the oleo-pneumatic type and shall be of heat treated steel.

4.6.12 Wheels. - Each nose gear wheel assembly shall be 6.50 X 8 size, of cast magnesium, split-type construction of a design configuration that will lend itself to ease of inspection. The wheel shall be suitable for mounting either conventional or tubeless tires.

4.6.13 Tires. - Each nose gear tire shall be tubeless 6.50 X 8, 6 ply Rating Type III.

4.6.14 Speed Brakes. - The main landing gear in the down position shall act as speed brakes for the airplane.

4.7 Brake System.

4.7.1 Brake Control System. - The brakes shall be hydraulically operated. Pressure on the brakes shall be directed through power brake valves operated by foot pads on the rudder pedals. The hydraulic systems to each set of brakes shall be independent of each other below the mechanism through which pressure is directed. Brake controls shall be provided for both pilots. In addition to the normal brake system, there is a normal/emergency brake system which can be put into operation by switching on the auxiliary hydraulic pump. In the event of failure of both sources of hydraulic pressure, the brakes shall be operated by means of the emergency/parking brake through an accumulator pressure system. The brake system is substantially as shown in the Hydraulic System Schematic on page 49. This system has a decelostat anti-skid unit installed at each brake.

4.7.2 Brake Assembly. - Single disk cast aluminum hydraulic brakes with organic lining and automatic wear adjustment shall be provided for each main landing gear wheel.

4.8 Nacelle Structure.

4.8.1 Description. - Each nacelle shall be of metal construction, permanently attached to the wing. Access doors and panels shall be provided. The nacelle structure shall be of aluminum alloy with steel or stainless steel used where required for strength and fire resistance. Each nacelle shall incorporate a recess for retraction of the main landing gear. Precautions shall be taken to preclude interference between landing gear assembly and wing and nacelle structure or protuberances. The nacelles shall incorporate hinged doors to close the wheelwell and obtain a faired contour.

5.0 POWER PLANT

5.1 Engines. - The airplane shall be equipped with two Rolls Royce Dart Mark 529-8X turboprop engines in accordance with paragraph 2.2 sub-par. 2.2.3 and each rated as shown below. (These are nominal engine ratings, minimum ratings are 96 percent of the value shown for dry power and 99 percent of the value shown for water/methanol power). F

Condition	R.P.M.	Jet Thrust	S.H.P.	Total Equiv. Horse Power	Fuel Consumption LB/SHP/HR
T.O. and Max. Continuous	15,000	501	1990	2185	.720
T.O. with Water/Methanol	15,000	525	2010	2210	——

5.1.1 Installation. - The engine, engine mount, engine mounted accessories, engine oil system, and propeller shall constitute a demountable power plant assembly. The installation shall be such as to provide removable units usable in any of the two airplane positions except as they may be affected by engine-mounted accessories peculiar to specific positions. The removal of a demountable power plant shall not impair the adjustment of the power plant controls in the airplane. Lifting shall be provided for handling the demountable power plane with or without the propeller installed by simple adjustment of the lifting sling.

5.1.1.1 Installation Approval. - The installation of the engine shall be approved by the engine manufacturer. Rolls-Royce engineering, design and installation departments shall make recommendations pertaining to the good functioning and reliability of the engine and the power plant system.

5.1.2 Air Induction System. - The leading edge of the engine cowling provides a smooth entry for the air and incorporates an air scoop leading to the oil cooler at the top of the engine. This scoop and the main intake are electrically heated to protect against icing.

5.1.3 Accessories. - A power take-off for an accessory gearbox is provided in the engine to power accessories for the airplane systems (Electrical, Hydraulic and Air Conditioning).

5.1.3.1 Description. - The aircraft gearbox driven accessories shall include the following for each engine:

One Tachometer generator
One Hydraulic pump
One D.C. generator
One Alternator (engine propeller & windshield anti-icer)
One Alternator (propeller synchronizing)
One Air Compressor (cabin blower, starboard engine only)

5.1.4 Compressor Bleed Air. - Bleed air is used for operation of the deicing boots and door seals.

5.1.5 Engine Maintenance. - Cowling shall be hinged at the fire wall and shall be capable of being peeled rearward to expose the entire engine for maintenance accessibility. Engine mounts shall be attached to the nacelle structure so as to be completely detachable and reinstallable without the use of jigs. Dowel pins or equivalent means shall be provided to facilitate aligning engine mount bolt holes when installing the power plant unit. Engine mounts shall permit the installation and removal of the power plant as a unit. The units of the engine are interchangeable with similar engine parts from Rolls-Royce stock.

5.1.6 Engine Controls. - The engine controls are described in paragraph 11.3, Flight Station. The engine control systems are substantially as shown in the schematic on page 33.

5.2 Propellers. - The propellers shall consist of two Rotol four-bladed propellers, 11 feet 6 inches in diameter. Other basic information is as follows:

Activity Factor	121 per blade
Integrated Lift Coefficient	0.45
Section Type	NACA Series 16
Pitch Range	0° - 85° 30'**
Pitch Locks	20° and 34.5°**

** Measured at the 0.7 radius station.

5.2.1 Propeller Anti-Icing. - An electric propeller anti-icing system shall be provided.

5.2.2 Propeller Feathering & Pitch Control. - The propeller controller unit is driven from the engine and is interconnected with the power lever. Automatic propeller feathering control is armed in the high power range by the power lever and activated by a loss of engine torque. Propeller feathering may be selected manually by means of the high pressure fuel cock which shall shut off fuel to the engine by the same action. Feathering pump controls and lights shall be prominently displayed and accessible to both pilots. The engine propeller gear ratio of .093.

5.2.3 Ground Fine Pitch Propeller Controls. - Ground fine pitch shall be obtained by removal of the 20° propeller pitch lock and deactivation of the propeller auto coarsening circuit. These functions shall be selected manually for both propellers simultaneously by means of a flight fine pitch lock selector handle. The prop ground fine pitch locks and the auto coarsening circuit shall be made effective by moving the propeller pitch interlock handle into the forward flight position.

5.3 Engine Starting System. - The starting system is controlled automatically by an electric panel mounted in the airframe. On pressing the starter button the starter motor is brought into operation.

High energy igniters are switched on simultaneously with the starter. Engine speed then rises until the engine is self-sustaining when both starter motor and ignitors are switched off automatically.

5.4 Exhaust System. - The exhaust system consists of a tailcone and a jet pipe together with necessary flanges, supports and attachments required to carry off exhaust gages. The system shall be designed so that:

(1) Connections and necessary supports will allow for thermal expansion without damage to the engine or exhaust system

(2) It will provide maximum practicable inherent suppression of exhaust flame without penalizing airplane performance

(3) It will allow removal and replacement in a minimum amount of time

(4) It will not collect fuel, oil, rain, or snow when the airplane is at rest

(5) It will provide for drainage or leakage therefrom to be conducted outside the airplane structure

(6) Exhaust gases shall be conducted to the atmosphere clear of the crew, tanks, fuel and oil drains, air intakes, and other inflammable parts of the airplane

(7) Parts shall be reasonably interchangeable with respect to installation and performance

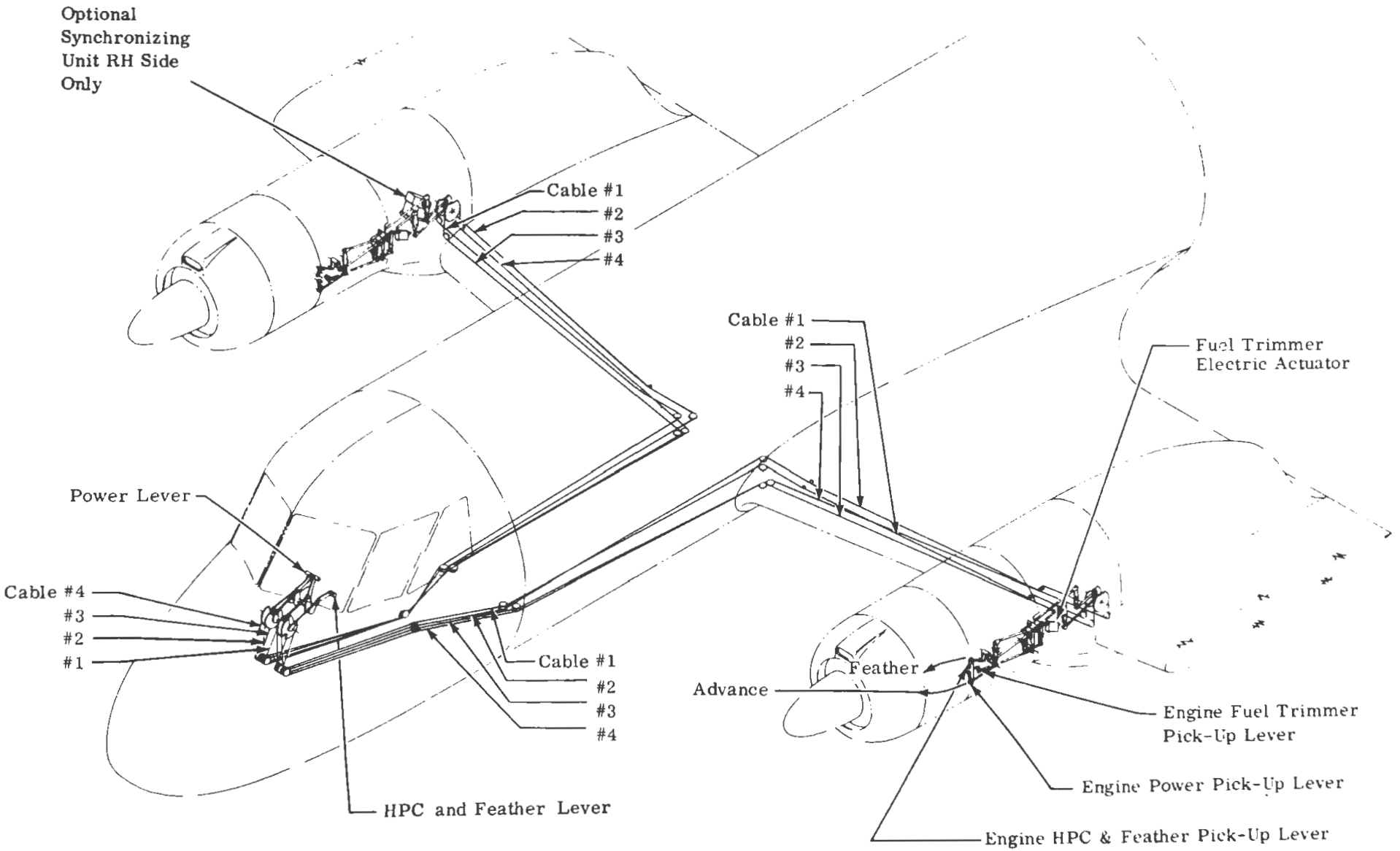
(8) Clamps can be easily installed and adjusted in service

5.5 Engine Lubrication System. - The oil system is completely self-contained within the engine. It provides jet lubrication for the bearings of the main shaft and reduction gear and an oil flow to the various driving gears and support bearings. It also provides oil for the propeller pitch operation. A reserve oil supply for feathering is maintained by means of a stand pipe. For design purposes, the weight of oil is calculated at 8.0 pounds per gallon.

5.5.1 System Pressure. - The system works at two oil pressures determined by a dual oil pressure relief valve. The higher pressure oil is taken to the propeller controller unit, where the pressure is further raised to operate the pitch change mechanism; the lower pressure is used for engine lubrication.

5.5.2 Oil Quantity. - The oil tank, an integral part of the engine, holds 33.6 U.S. pints of oil. In addition, 11.4 pints of oil are circulated by the pressure pump for engine lubrication and 11.4 pints are isolated from the pressure pump by a stand pipe, thus ensuring that an adequate quantity of oil is available at all times for feathering of the propellers. The remaining volume is used up by airspace and expansion of the oil when heated.

5.5.3 Engine Oil Drain. - Engine oil drain valves shall be readily accessible.



Engine Control System Schematic

5.5.4 Oil Quantity Gaging. - Oil quantity gaging shall consist of calibrated dip sticks and the service oil tank zero-oil-level shall be indicated at zero-usable oil.

5.5.5 Oil Pressure Gaging. - Provision shall be made for indicating the oil pressure in the low pressure lubricating system on the discharge side of the pressure pump. A warning light to indicate low pressure shall be provided for each engine.

5.5.6 Oil Temperature. - Oil temperature indicating equipment shall be provided.

5.6 Nacelle Group. - The nacelle group includes engine mount and fittings, fire walls, nacelle structure and cowling.

5.6.1 Nacelle Structure. - Nacelles shall be faired into the wing. Flammable structural materials shall not be used inside engine compartments. Washers or engine-mounting parts of materials that absorb or that are adversely affected by fuel or lubricating oil shall not be used in the engine compartment or near fuel and oil tanks.

5.6.2 Nacelle Fire Walls. - Fire walls shall be of steel or equivalent fire resistant materials. Fire walls shall be capable of withstanding 2000° ± 50°F. flame over an area of approximately 5 square inches for a period of 15 minutes without penetration.

A fire wall extending from the top to the bottom of the nacelle shall separate the gearbox and the main landing gear wheel bay from the combustor section of the engine. Electrical and hose connections on the fire wall shall be labeled to facilitate power plant changes wherever practical.

5.6.3 Cowling Design. - The cowling shall be ventilated to prevent accumulation of gases, to insure proper cooling of the engine, and to prevent high temperatures in the engine compartment, accessory compartment, or inhabited spaces. Vents and joints in cowling shall be located out of the path of jet wake, and joints shall be flame tight. Cowling shall permit the maximum engine deflections without over-stressing the cowling.

5.6.4 Cowling Attachment. - Cowling shall be securely attached to the engine and to structural truss members. Cowling, fastenings, and supports shall provide minimum drag and maximum engine protection from the weather. Where metal parts necessarily rub, easily replaceable strips shall be provided to prevent chafing.

5.7 Engine Cooling. - Cooling for engine components shall be provided in accordance with the requirements of each component.

5.8 Fuel System.

5.8.1 Description. - The airplane fuel system shall include tanks, piping, quantity gaging, low pressure warning, automatic and manual fuel heating, and functional equipment and arrangement necessary for required fuel feed, cross flow, fueling and defueling systems. The fuel system is substantially in accordance with the drawing shown on page 38.

5.8.1 Description. - (Cont.)

An independent fuel system shall be provided for each engine. It shall consist of two integral fuel tanks located in the wing box beam. No fuel tanks shall be carried within the fuselage. Each tank shall have a usable capacity of 775 U.S. gallons. A cross flow line will permit the pilot to feed an engine from the tank in the opposite wing.

5.8.2 Fuel Feed System. - The fuel feed system controls the flow of fuel to maintain a satisfactory fuel-to-air ratio over the whole operating range.

5.8.3 Fuel Quantity Gaging. - A null balancing capacitor type quantity gage system shall be provided to gage each fuel tank. Two separate 2-inch indicators shall show the total fuel in pounds remaining in tanks in each side of the airplane. A low level fuel warning light integral with the system shall be provided for each tank. A separate 2-inch fuel flowmeter indicator and system shall be provided for each power plant.

5.8.4 Fuel Pressure Indication. - Low fuel pressure warning indicators shall be provided.

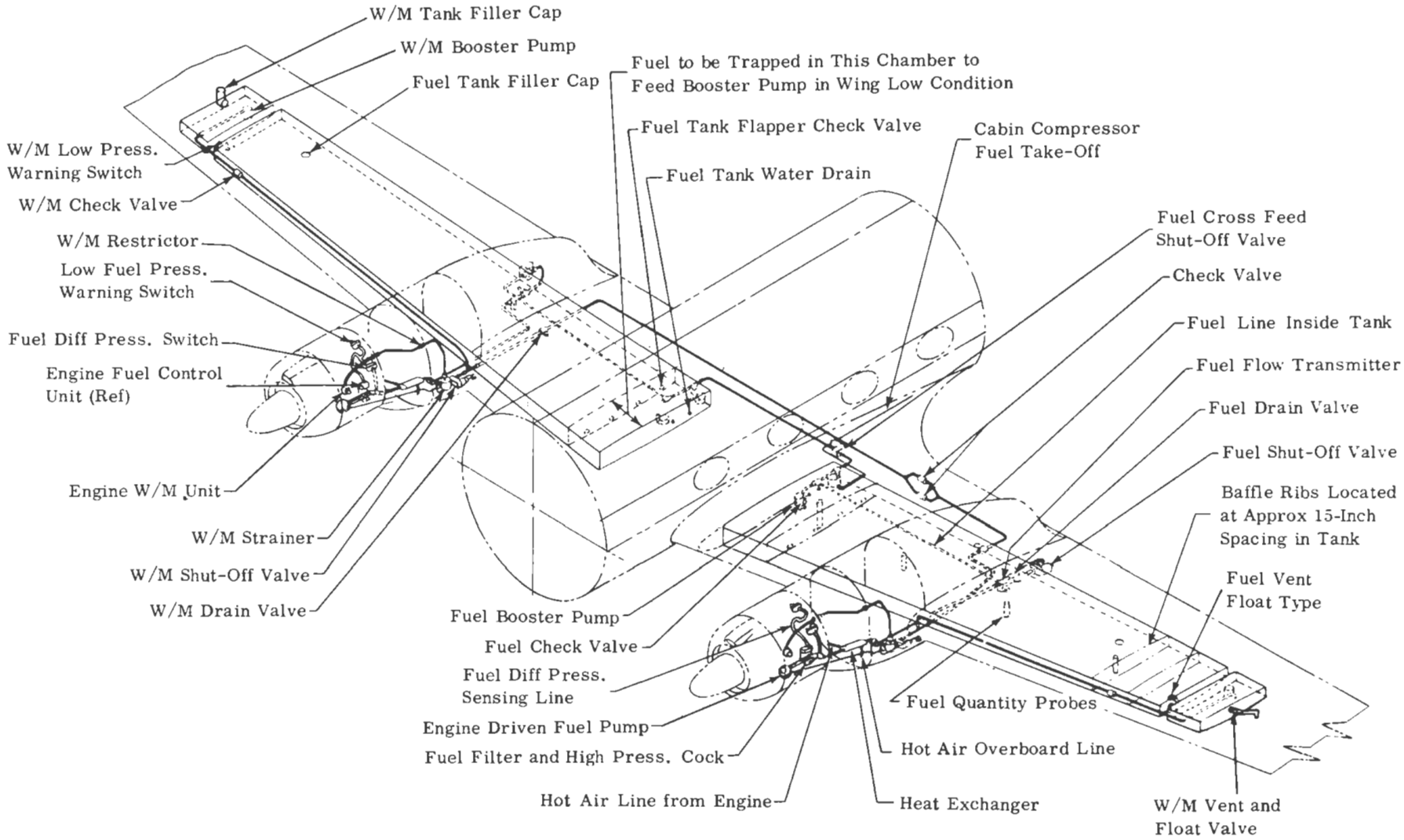
5.8.5 Fuel Filters. - An integral fuel filter shall be provided for each engine feed system. A fuel hot bleed air heat exchanger shall be provided to protect each filter against ice accumulation and blockage. The filter elements shall be readily removable for periodic inspection.

5.8.6 Drainage. - A container shall be provided for collecting fuel from the main engine drain manifold when the airplane is at rest in the normal attitude on the ground. The container shall be of sufficient capacity to provide one normal shut-down and two false starts and shall be capable of being drained automatically on the ground at approximately 11,000 R.P.M. so that fuel will drain clear of all parts of the airplane. Drainage from the engine heat shield shall go directly overboard. The fuel system shall be drained manually through a drain valve while at rest so that fuel will not be discharged on the airplane.

5.8.7 Overwing Fueling System. - A conventional, flush, fuel tank filler shall be provided in the top of each tank. The leak proof cap shall be provided with a restraining chain when detached. Means shall be provided for grounding the fuel hose nozzle.

5.9 Water/Methanol System. - A water/methanol injection system of the compressor inlet type, shall be installed to restore take-off power when operating under high ambient temperature conditions. For design purposes, the weight of water/methanol is calculated at 7.85 pounds per gallon. The water methanol/system is in general accordance with the drawing shown on page 38.

5.9.1 Water/Methanol Specification. - Rolls-Royce Specification, Type 1 water/methanol mixture AEP-1-W/M, latest revision.



Fuel & Water/Methanol Systems

5.9.2 Water/Methanol Quantity Gaging. - A continuous reading quantity indicator shall be provided for each water methanol tank. Each of the water methanol tanks in the wing will have a capacity of approximately 23 gallons and will be vented overboard through non-icing ram vents.

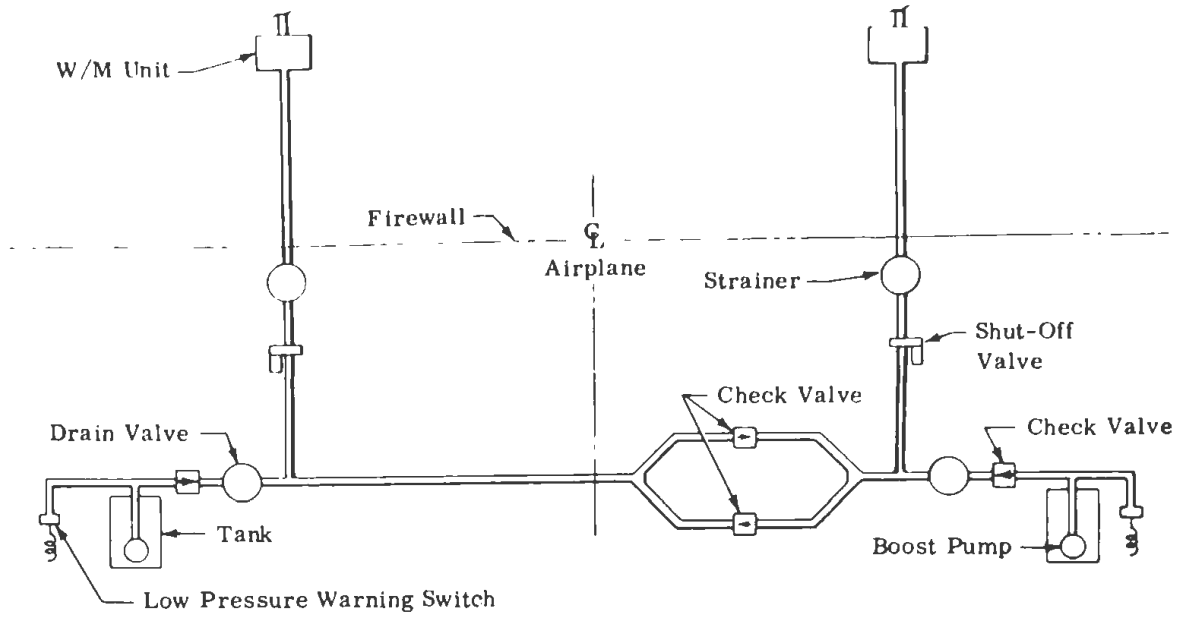
5.10 Engine and Nacelle Fire Detection and Extinguishing Systems

5.10.1 Fire Detecting and Warning. - Continuous type fire detection will be provided in the compressor-accessory section and in the combustion-turbine sections. A separate system is provided in the tail pipe section of each nacelle.

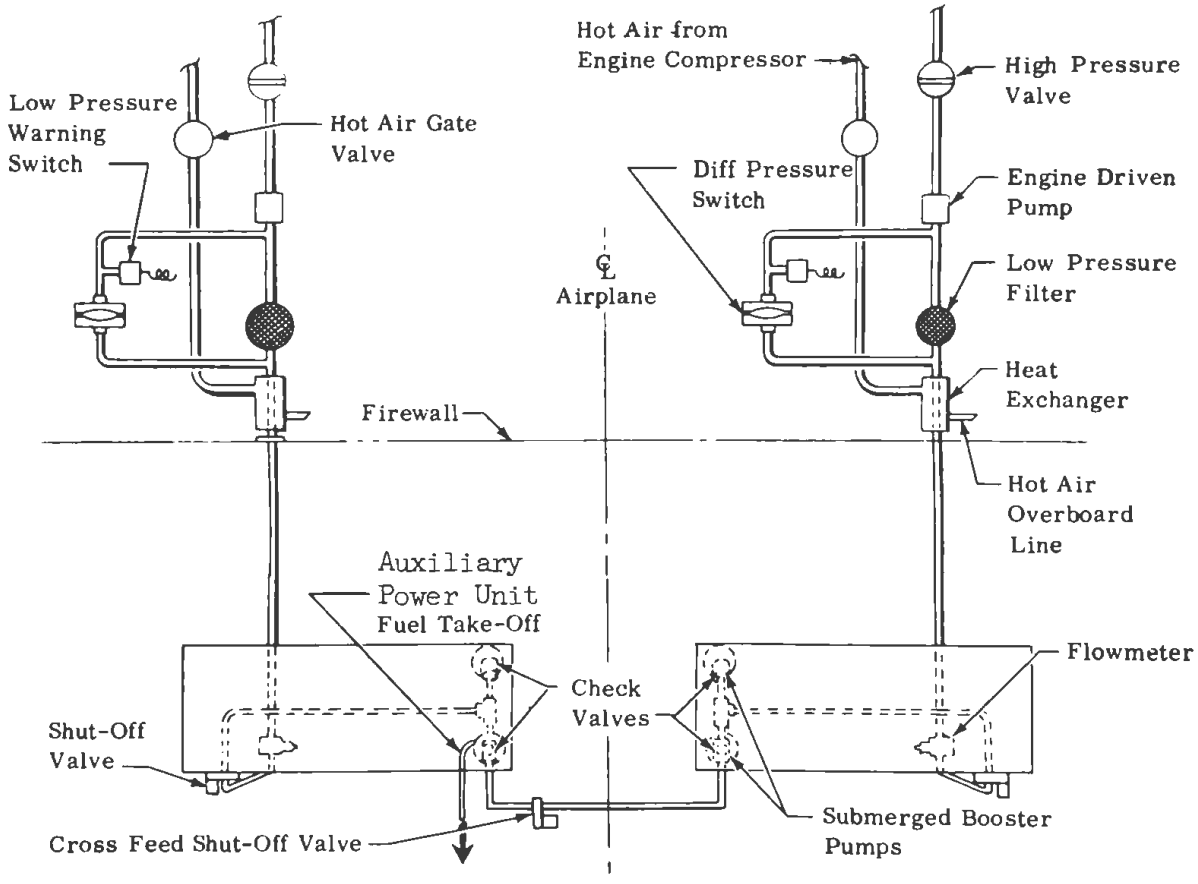
5.10.2 Fire Extinguishing. - A two-shot system shall be installed for the protection of the engines. A container of Bromotrifluoromethane (CF_3Br), a non-toxic extinguishant, shall be provided in each nacelle. The system shall be arranged so that the agent in either bottle may be discharged into the compartments of either engine. Each shot shall discharge in approximately 2 seconds at ambient in-flight temperatures as low as -65°F. The distribution lines, rings, and fittings in the engine bays shall be of fireproof material. Each nacelle will have a thermal relief indicator and a system discharge indicator for its respective container. The system will permit discharge of each bottle into its respective engine bay and tail pipe section in the event of a premeditated crash landing. The system layout is substantially in accordance with drawing on page 39.

5.10.2.1 Fire Extinguishing and Fire Wall Shut-Offs. - When an engine emergency shut-off handle is pulled, valves for the fuel, water methanol, and hydraulic fluid are shut off and the AC alternator and the DC generators are disconnected. This manipulation of the handle uncovers the fire extinguisher discharge switch for that engine.

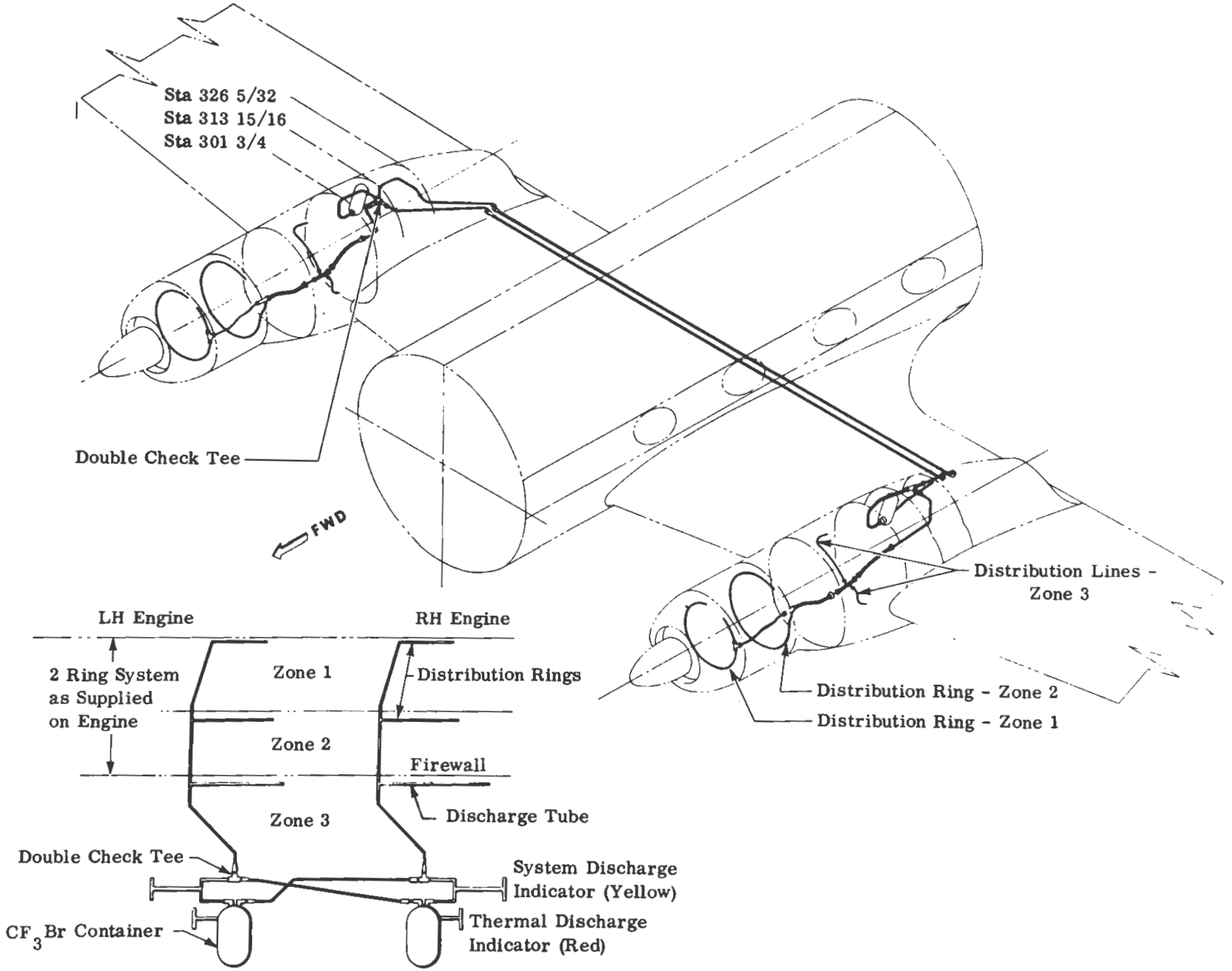
5.10.2.2 Bottles. - One bottle containing approximately 9.5 pounds of Bromotrifluoromethane shall be located in each nacelle. Bottles shall be made of steel and protected against corrosion. Each bottle shall have a pressure gage, integrally installed and easily visible through a transparent window in the side of the nacelle above the wing. Each bottle shall be quickly replaceable.



Water/Methanol System Schematic



Fuel System Schematic



Fire Extinguishing System Schematic

6.0 INSTRUMENTS

6.1 General. - Instruments shall be provided for the pilot and/or copilot as shown in Appendix B.

6.1.1 Graduation Units. - All instruments provided shall be adjusted for use. All instruments shall be graduated in United States units of measure for land planes (feet per minute, gallons, pounds) except for temperature indicators. All temperature indicators shall be graduated in degrees Centigrade, except cabin temperature indicators, which shall be graduated in degrees Fahrenheit. All fuel quantity indicators shall be graduated in pounds.

6.1.2 Mounting and Connector Requirements. - The flight station instrument panels shall be solid mounted to the fuselage. The panels shall be easily removable. Hoses shall be identified to prevent crossed lines.

6.2 Instrument Markings. - All instruments requiring range markings shall have the operating range markings on the dial face of the instrument.

6.2.1 Instrument Dial Face Finish. - The instrument dial face finish shall be black with white matte lettering, except as covered by range markings.

6.3 Fuel Flow Transmitters. - Fuel flow transmitters shall be replaced without completely draining the fuel tanks.

6.4 Warning Lights. - The following indicator and warning lights shall be provided:

Master Caution Light Display Panel

A.C. Instrument Bus
A.C. Main Bus
A.C. Equipment Bus
Left Generator Off
Right Generator Off
Left A.C. Generator Off
Right A.C. Generator Off
Left Fuel Pressure
Right Fuel Pressure
Left Water Methanol Pressure
Right Water Methanol Pressure
Blower Hot
Cabin Pressure
Left Generator Hot
Right Generator Hot
Left A.C. Generator Hot
Right A.C. Generator Hot
Left Fuel Quantity
Right Fuel Quantity
Radios Hot
Left Oil Pressure
Right Oil Pressure
Doors Unsafe
Ignition On
Autopilot
Left Gearbox Pressure
Right Gearbox Pressure
Outside Battery Switch

Landing Gear

Nose Wheel Down Light
Right Main Wheel Down Light
Left Main Wheel Down Light
No Horn Warning Light

A.P.U.

A.P.U. Start Indicator Light
A.P.U. Run Indicator Light
A.P.U. Oil Pressure Warning Light
A.P.U. Generator Warning Light

6.4 Warning Lights. - (Cont.)

Propeller

Right Feather Pump Indicator Light
Left Feather Pump Indicator Light
Right Cruise Lock-out Light
Left Cruise Lock-out Light
Right Below Flight Fine Pitch Lock Light
Left Below Flight Fine Pitch Lock Light
Cruise Pitch Lights (2)
Flight Fine Pitch Lock Lights (2)

Engine Inlet Deice

Right Engine Deice Pulse Indicating Light
Left Engine Deice Pulse Indicating Light

Miscellaneous Warning Lights

Left Pitot Heat Indicator Light
Right Pitot Heat Indicator Light
Left Aft Nacelle Fire Warning Light
Right Aft Nacelle Fire Warning Light
Left Fire Warning "T" Handle Light
Right Fire Warning "T" Handle Light
A.P.U. Fire Warning Light
Tail Deicing Indicator Light
Windshield Heat Indicating Lights (4)
Right Master Caution Light
Left Master Caution Light
Landing Light Extend Indicator Light
Fuel Cross Feed Indicator Light
Right Fuel Filter Heat Indicator Light
Left Fuel Filter Heat Indicator Light

6.4.1 Navigational Chart Stowage. - Provisions for stowing charts, cards, computers and handbooks shall be provided.

6.4.2 Compass System. - Provisions for two complete, independent gyro stabilized directional compass indicators are provided.

6.4.3 Weather Radar. - Provisions for "C" or "X" band weather radar of 150 mile range shall be provided. Suitable radome and wave guide installations shall be part of such provisions.

6.5 Pitot-Static System. - An independent pitot-static system shall be provided to serve the appropriate flight instruments for each pilot. Each system will consist of a pitot tube and two flush static ports, one on each side of the airplane at Sta. 639-13/16. Drain ports will be located at each low point of the static line run to permit periodic draining of any condensed moisture that may accumulate in the run. An alternate static pressure source shall be provided such that either pilot can select an alternate source. Selection of the alternate static source shall be accomplished manually by means of a selector valve provided on the lower outboard portion of each pilot's instrument panel. The pitot heads shall be electrically heated.

6.6 Propeller Operating Lights. - Four sets of lights shall be provided to indicate the pitch of the propellers in the various stages of operation as detailed in para. 6.4.

7.0 SURFACE CONTROLS

7.1 General. - Control cable systems shall be of the conventional, manually operated type. Routing of cables shall be as direct as possible. Means shall be used at appropriate locations to prevent fouling or chafing of cables. Corrosion resistant steel and lockclad steel cables shall be used. Pulleys or bellcranks shall be provided at all locations where cable change in direction exceeds 3 degrees. Cables shall be protected against corrosion. Anti-friction bearings shall be used throughout the control systems. Control cables shall incorporate turnbuckles at appropriate locations for rigging adjustment and cable replacement. Control rods shall incorporate means of adjustment where required Positive stops shall be provided at the control columns, aileron wheels, and rudder pedals to prevent movement beyond that necessary to operate the control surfaces to specified limits.

7.2 Flight Controls. - Complete dual controls in the form of wheels, columns, and rudder pedals shall be provided for the pilot and copilot. The flight controls shall be conventional in operations. Each set of rudder pedals shall be adjustable fore and aft by a unitary control to accommodate pilots of various statures. The design of the control systems and cable routing shall be such as to minimize the possibility of inadvertent cross-connecting of control elements.

7.3 Flight Controls Systems. - The primary flight control systems shall consist of the longitudinal control system, lateral control system and the directional control system. A trim control system shall be provided in conjunction with the primary control system.

7.3.1 Aileron System. - The aileron control system is operated by a manual system of pushrods, bellcranks and cables. A spring tab is fitted at each aileron to reduce hingle moment. A trim tab is provided on the left aileron only. The lateral control system is substantially as shown in the schematic on page 44.

7.3.2 Elevator System. - The control columns are connected by a torque tube and fed into a single elevator control system. The cables carry the forces back to another pushrod and bellcrank system at the elevator resulting in elevator movement. There is one trim tab provided on each elevator. The longitudinal control system is substantially as shown in the schematic on page 45.

7.3.3 Rudder System. - A combination spring-trim tab is incorporated in addition to balancing for reduction of hinge moments. The rudder pedals are connected to a torque tube which in turn feeds into a single rudder control system. Rudder spring tab-input is available in the flaps down configuration. The spring tab is shifted out when in the flaps up configuration. The directional control system is substantially as sown in the schematic on page 46.

7.3.4 Trim Tab Control. - The aileron, elevator, and rudder trim tab control systems shall consist of closed cable installations, shall be operated manually by individual controls accessible to both pilot and copilot, and shall be irreversible. A trim indicator shall be located on each trim tab control.

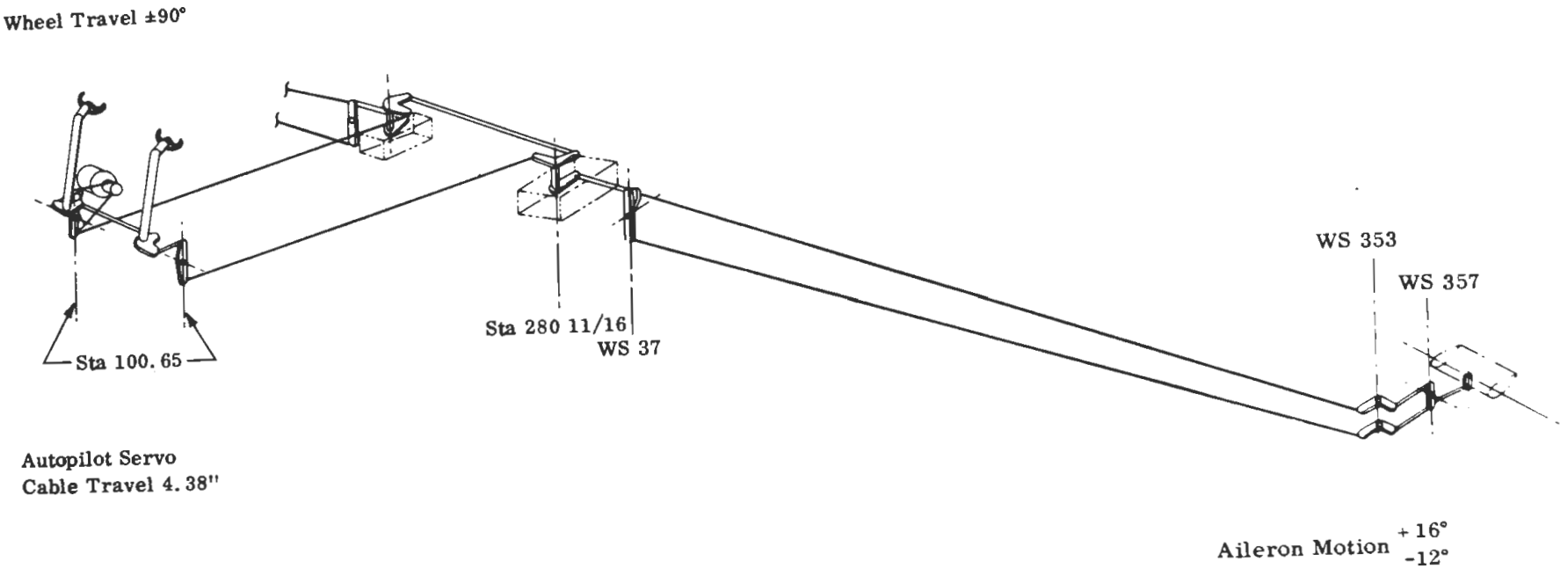
7.3.5 Locks. - The ailerons, elevators, and rudder shall be locked against gust loads by mechanical latches located on or near the skin surfaces. The control surfaces locked in this manner shall be capable of withstanding gusts of 60 knots.

7.3.6 Wing Flaps. - Each wing flap is of one piece construction operating on four tracks. Two mechanical drives per side, powered by a single hydraulic motor in the wing center section, operate flaps. A flap position indicator is provided on the center instrument panel as shown in the drawing on page 60.

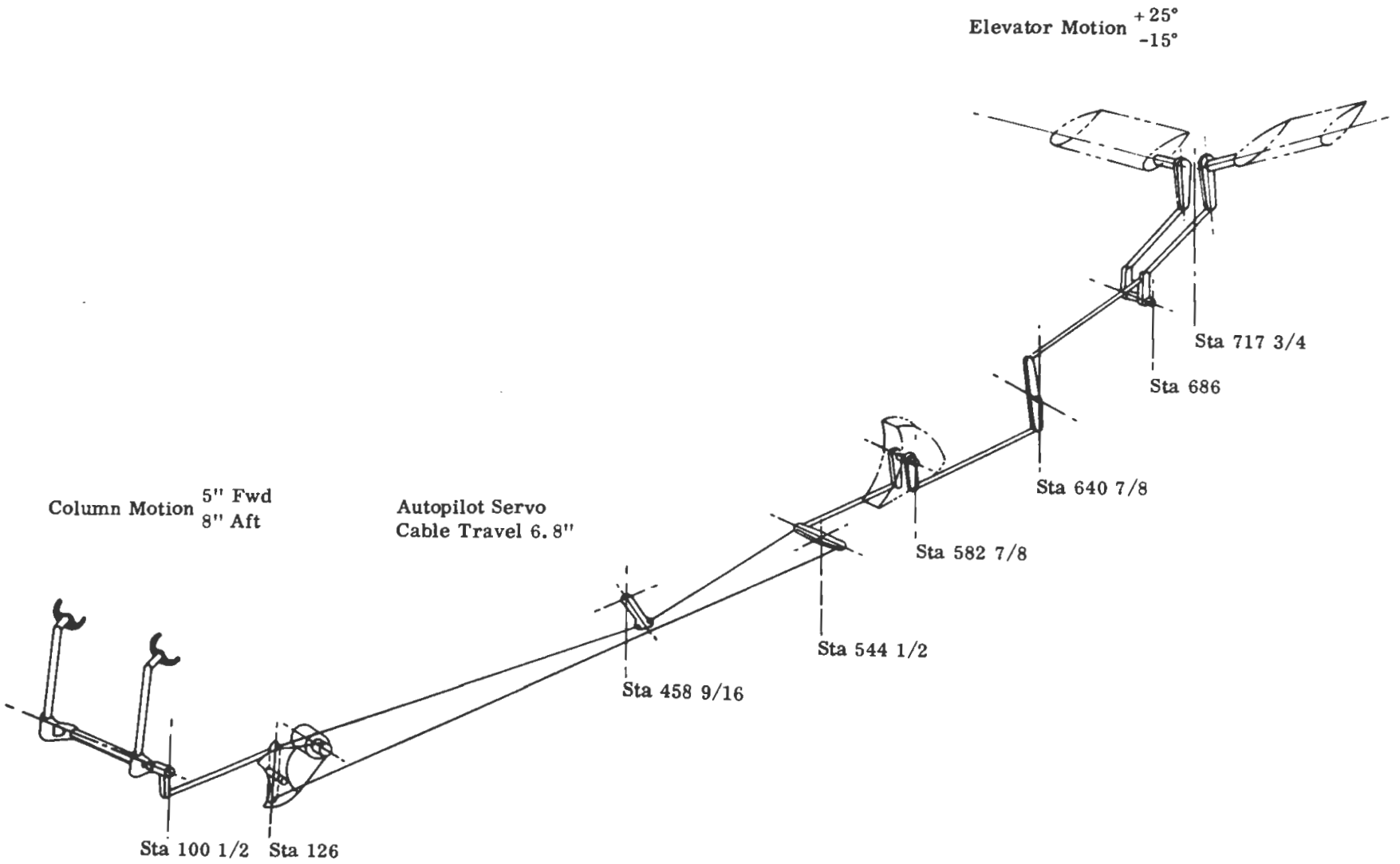
7.3.7 Speed Brake Control. - The speed brake shall consist of the main landing gear in the extended position and shall be controlled for use as a drag increasing device. Activation of the speed brake is accomplished by the aft movement of a handle on the pedestal.

7.4 Automatic Pilot. - Provision for an automatic pilot system shall be provided. Installation and electrical wiring of the auto pilot shall be arranged through the distributor. The following automatic pilots have been certified for installation in the Gulfstream.

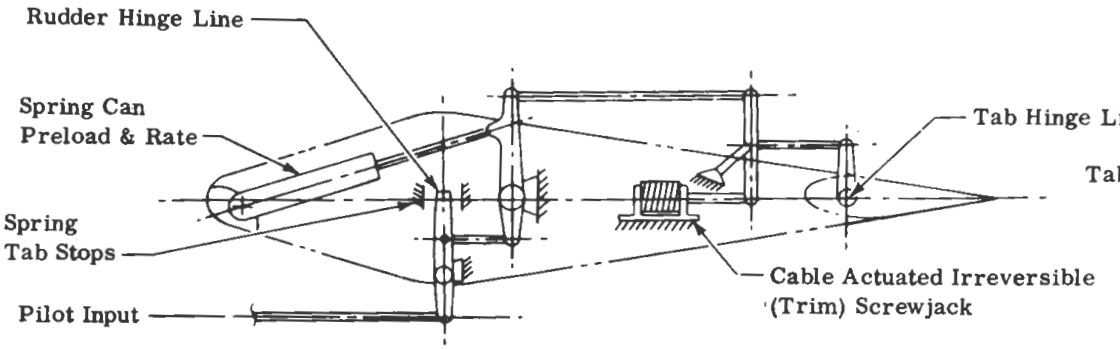
(1) - Sperry - SP-20
(2) - Sperry - SP-40
(3) - Collins - AP-101E
(4) - Collins - AP-103



Lateral Control System Schematic



Longitudinal Control System Schematic



Spring-Trim Tab Schematic

Directional Control System Schematic

8.0 NORMAL AND EMERGENCY HYDRAULIC SYSTEMS

8.1 Description. - The hydraulic system shall be a 1500 psi system, with pressure supplied by two variable volume, engine driven pumps. The hydraulic fluid shall be an aircraft phosphate, ester base fluid, such as Skydrol - 7000 (fire resistant) manufactured by Monsanto Chemical Company.

8.1.1 Summary of Actuated Items. - The following items shall be hydraulically operated.

1. Wing Flaps
2. Land Gear
3. Wheel Brakes
4. Door and Stairway
5. Windshield Wipers
6. Nose Wheel Steering

In case of an emergency, the wing flaps may be operated by the use of an auxiliary electric motor driven pump. Landing gear doors, uplock release, and nose gear can be operated by the use of the emergency air bottle system. Main gears shall extend and lock down by gravity and aerodynamic effect. The hydraulic system shall be in general accordance with schematic diagram shown on page 49.

8.1.2 Hydraulic Fluid Weight. - For design purposes, the weight of hydraulic fluid shall be calculated at 9.0 pounds per gallon.

8.1.3 Finish of Detail Parts. - All internal as well as external hydraulic parts shall be made of corrosion-resistant material or shall be suitably protected against corrosion.

8.1.4 Installation. - A hydraulic reservoir is located on the port side, aft of the main entrance door. Ground test fittings are located on the outboard side of the starboard nacelle. The electrically-driven hydraulic pump is in the nose wheelwell.

8.1.4.1 All hydraulic units shall be installed so that they can be readily inspected and accessible for maintenance.

8.2 Valves

8.2.1 System Relief Valve. - A relief valve shall be provided in the system to ensure that pressure in any portion of the hydraulic system will not exceed a safe limit above the cut-out pressure of the pumps. This valve shall be capable of by-passing full flow of a pump.

8.2.2 Thermal Relief Valves. - All closed systems shall incorporate relief valves where required to ensure that pressure resulting from thermal expansion does not exceed the safe limit of the system.

8.2.3 Nose Wheel Steering Valve. - A directional control valve shall be provided to accomplish nose wheel steering.

8.2.4 Brake Shuttle Valves. - Shuttle valves shall be provided at the brakes.

8.2.5 Gages. - Direct reading pressure gage shall be provided in the cockpit to allow the pilot to check pressure prior to take-off and landing and to facilitate ground charging. There are two pressure gages on the main R.H. instrument panel skirt; one for the normal hydraulic system, and one for the auxiliary hydraulic system. In addition, there is a parking brake accumulator pressure gage on the R.H. flight instrument panel. A fluid level indicator shall be provided at the reservoir.

8.3 Reservoirs. - The main reservoir shall be installed so that it may readily be filled, drained or removed from the airplane.

8.3.1 Filters. - High pressure type filters shall be provided in each pump pressure supply line as close to the pump as practicable. Means shall also be provided on the aircraft to filter hydraulic oil introduced from a ground power source. A case drain filter shall be provided for the hydraulic pumps so that used drain oil from each pump will be filtered before it returns to reservoir.

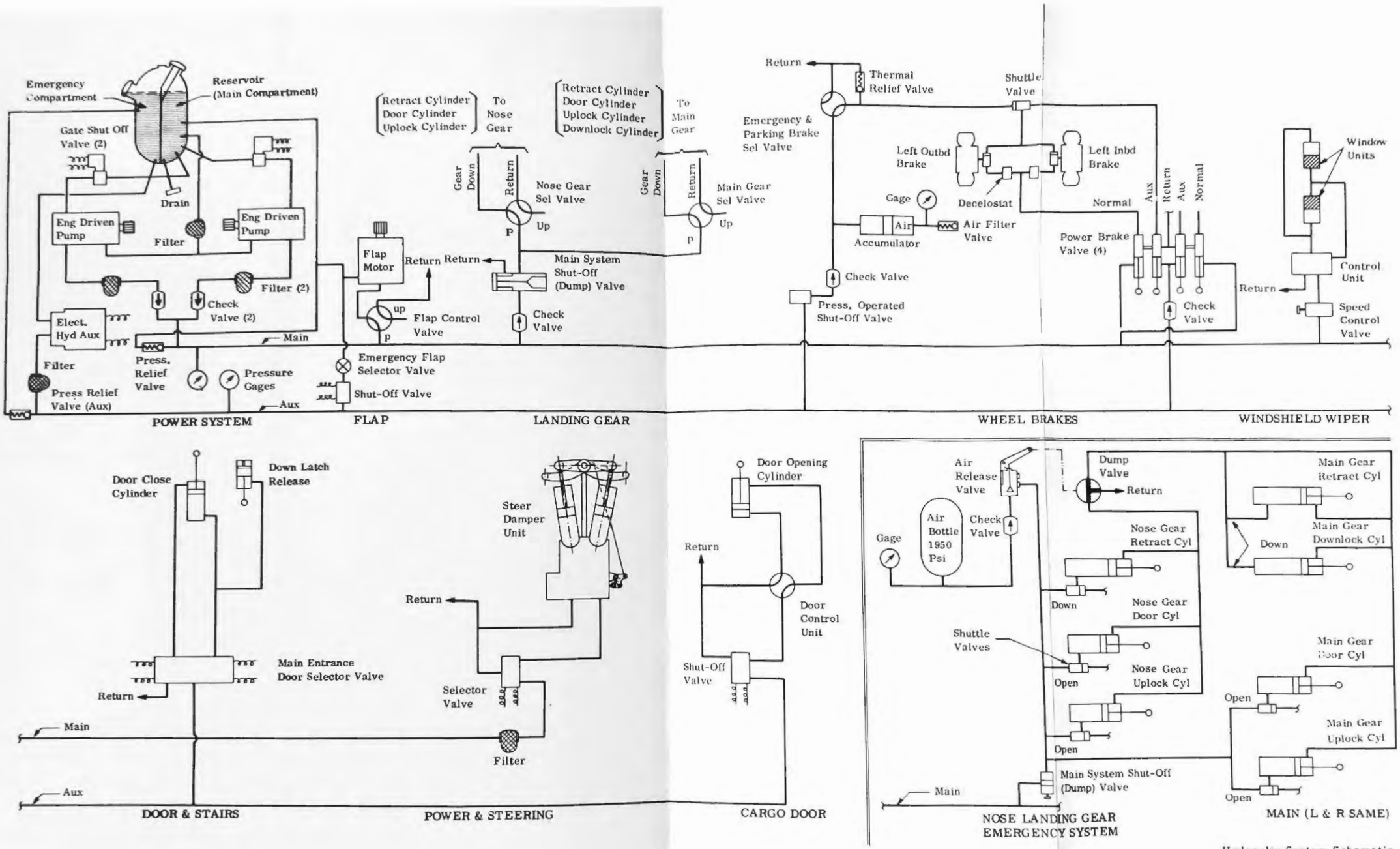
8.3.2 Accumulators. - An accumulator shall be provided for the emergency brake system and in addition shall provide for the parking brake requirements.

8.3.3 Windshield Wipers. - Hydraulically-operated windshield wipers shall be provided for both forward windshield panels. They shall not block the pilot's vision when in the off position. The wiper control shall be accessible to the pilot and copilot.

8.4 Emergency Brake System.

8.4.1 General. - An emergency brake system shall be provided for use in the event of a hydraulic system failure. (See paragraph 4.7.1).

8.4.2 Installation. - The landing gear emergency air supply bottle shall be accessible for inspection and recharging. A suitable filler valve and pressure gage shall be located adjacent to the air bottle to facilitate ground charging.



Hydraulic System Schematic

9.0 ELECTRICAL SYSTEM

9.1 Description. - The electric system furnishes both A.C and D.C. power to the airplane. The complete electric system is composed of the following components:

1. Primary System
2. Secondary System
3. Standby System
4. Auxiliary System

9.1.1 Primary System. - The electrical system is energized by two D.C. generators, one on each engine, connected in parallel. Either D.C. generator is capable of indefinitely carrying the major electrical loads in the event of an engine failure.

9.1.2 Secondary System. - The secondary system is the A.C. power system and is composed of two 2500 VA inverters and one 250 VA inverter powered by the D.C. generators.

9.1.3 Standby System. - The standby system consists of battery power.

9.1.4 Auxiliary System. - The auxiliary system consists of two A.C. Alternators, one driven by each engine accessory gearbox.

9.2 Electrical Power Supply

9.2.1 Generators. - Two wide-speed range 300 amp. 28-volt generators, specially designed for 8000 Gen. RPM operation, are operated in parallel, feeding the main D.C. bus. One is driven by each engine gearbox.

9.2.2 Inverters. - Three inverters shall be provided to furnish constant frequency A.C. power for instrument and electrical systems. The inverters are labelled A, B, and E. The "A" inverter supplies all fixed frequency power requirements. The "B" inverter is a standby for "A" and can be brought into operation through manual switching. A small emergency unit, labelled "E", supplies essential instruments only in case inverters "A" and "B" are not running. This switch-over can be accomplished either automatically or manually.

9.2.3 Alternators. - Two, three-phase variable speed alternators for anti-icing (one for each engine) shall be provided. The loads supplied by these units are: propeller blade and spinner anti-icing, engine air intake anti-icing and electrical windshield anti-icing.

9.2.4 Batteries. - Two 24-volt nickel cadmium storage batteries are provided, one in each nacelle, to operate the engine starting components, minimum cabin lighting, entranceway lighting and minimum flight station lighting; or to permit operation of essential flight instruments and emergency equipment for approximately 30 minutes when primary power is not available. Provisions shall be made to permit installation or removal of the battery on the ground. They are connected to the main bus by contactors and a single switch gives the pilot control of both batteries.

9.2.5 Voltage Control. - Carbon pile regulators shall be provided to maintain constant regulated voltage.

9.2.6 Protective Systems. - Each D.C. generator is provided with an over-voltage sensing unit, which shuts the machine down by opening its field if for any reason the voltage rises dangerously. Pilot-controlled switches for each generator allows selection of "ON", "OFF", "RESET" or "TRIP".

9.2.6.1 Alternator Protection. - Each alternator system is provided with over and under voltage protective devices which act to shut the system down in case of failure. Cockpit switching allows selection of "OFF", "ON" and "RESET" for each alternator system.

9.2.6.2 Accessibility. - Regulators and over-voltage devices are easily accessible for replacement. Being adjacent to one another, paralleling can be most readily accomplished. Bus pinjacks are provided next to the regulators to assist in this operation.

9.3 Power Distribution. -

9.3.1 D.C. Distribution System. - Main D.C. current is distributed from the main D.C. bus. Portions of the bus which are connected to essential equipment are provided with circuit protective devices for maximum reliability. There is a monitored D.C. bus to reduce loading on the D.C. system when the engines are idling while on the ground or in flight with a double generator failure.

9.3.2 A.C. Distribution System. - There is a fixed frequency distribution system which consists of the main A.C. bus, the equipment A.C. bus and instrument A.C. bus. The equipment bus system is normally connected to the main bus system but in the event of the failure of the main bus, the equipment bus automatically connects to the instrument bus. All safety-of-flight instruments are connected to the instrument bus, which is powered directly by any active inverter.

9.3.2.1 Variable Frequency Bus. - The de-icing equipment for each engine is fed wholly by the engine alternator. Heating elements in the front window panels of the cockpit are fed from the port engine alternator. A transfer unit is provided which allows the elements to be fed from the alternator on the starboard engine. Direct vision windows and side windows (if heated) take their power from the right alternator.

9.3.3 Essential Bus System. - Certain equipments of primary importance are connected to portions of the D.C. bus and are termed the D.C. essential bus. This bus is provided with separate protection. In addition, the power for this bus may be routed via either of two paths. Control of this routing is via battery control switch.

9.4 Power System Controls

9.4.1 Power Switches. - An advisory control panel with positive power failure indication shall be provided. A manual switch shall be provided to control the connection of the buses to the external power source. A multi-switch actuating device (gang bar) is provided to permit rapid selection of an emergency power source for the essential bus. This device also deactivates other power sources permitting rapid isolation of electrical faults.

9.4.2 Metering. - D.C. generator voltmeters and ammeters are provided. A D.C. bus voltmeter is provided along with an A.P.U. generator - ammeter. An A.C. voltmeter is provided which can be switched to measure the potential of any A.C. source.

9.5 Electrical Installations

9.5.1 Equipment. - Equipment shall be, insofar as practical, installed to permit ready inspection, access and replacement without removal of unrelated pieces of equipment.

9.5.2 Equipment Identification. - Identifications of equipment and relays shall be made by means of placards or other suitable markings.

9.6 Wiring, Junction Boxes and Conduit. - The distribution system wiring shall be routed as open wiring harnesses or through rigid or flexible conduits, troughs, junction boxes and terminal connector strips. All wire, cable, conduits or troughs shall be suitably supported adjacent to the structure to eliminate abrasion.

9.6.1 Wiring. - Wiring in the electric system shall be in accordance with GAEC commercial practices. Wire size shall be determined from the maximum current carrying capacity of the wire, except where the voltage drop requires larger sizes for satisfactory operation. Wiring shall be run in open harnesses securely attached to structure except where necessary to accomplish any of the following, in which case troughs or conduit shall be used:

(1) To reduce radio noise.
(2) To protect wire against mechanical damage from deterioration caused by exposure to liquids or heat.
(3) To facilitate replacement of wire installed behind cabin lining or in other inaccessible areas.

9.6.2 Junction Boxes. - Where accidental contact with control cables, mechanic's tools, loose hardware and drill cuttings is possible, electrical buses and terminals shall be protected in boxes or enclosures.

9.6.2.1 Terminals. - Spare terminals or space provisions for additional terminals shall be provided as practical in all multi-circuit junction boxes and terminal areas.

9.6.3 Conduits and Troughs. - Conduit and trough installations shall be such as to prevent chafing of wires on sharp edges. Wire runs shall be smooth and free from kinks. All bends shall be made over as large a radii as possible. The wire bundle or bundles shall not fill more than 90 percent of the maximum capacity of the conduit or trough. This does not apply to individual harnesses connected to individual electrical components.

9.6.4 Connectors. - The installation of connectors shall be such that impairment of the circuits concerned will be prevented during normal service life. Installation procedures for connectors shall include appropriate measures to prevent harmful effects from factors related to the environment of the connectors such as corrosion and/or contamination by fluids, gases, and foreign material. Spare wires shall be installed where practicable. Connectors may be potted where required to improve resistance against corrosion.

9.6.4.1 Splices. - Permanent wire splices may be used at production breaks where disconnects are not required for maintenance.

9.6.5 Equipment Installation and Wiring. - All electrical equipment, controls and wiring shall be so installed that operation of any one unit or system of units will not adversely affect the simultaneous operation of any other electrical unit or system of units essential to the safe operation of the airplane. All cables shall be grouped, routed and spaced so that damage to essential circuits will be minimized in the event of faults in current-carrying cables. Insofar as practical, controls, switches and instruments pertaining to the same function shall be grouped.

9.7 Circuit Protection

9.7.1 Circuit Breakers. - Trip free circuit breakers shall be provided

9.7.2 Fuses. - Fuses (current limiters) shall be used where necessary and sufficient spares shall be provided.

9.8 Exterior Lights

9.8.1 Position Lights. - A green position light shall be provided on the right wing tip, a red position light shall be provided on the left wing tip, and a white position light shall be provided on the aft portion of the aircraft. The lights shall be controlled by a "ON-OFF" switch on the overhead panel.

9.8.2 Landing Lights. - Two 600-watt sealed-beam landing lights shall be provided. The landing lights shall be electrically retractable and shall be controlled by switches in the flight station. The lighting and extension of the lights shall be controlled by separate switches to enable the lights to be turned on in any position. The down limit switch shall be adjustable on the ground. Lamps shall be readily replaceable.

9.8.3 Anti-Collision Lights. - Light units shall be provided in the leading edge of the fin cap, in the tail cone and in the bottom of the fuselage. The control switch on the overhead panel shall be provided with three position "ALL ON", "OFF" and "BOTTOM ONLY", so that in heavy clouds, the fin mounted unit may be turned off to minimize any vertigo effects on the pilot caused by the rotating beams.

9.8.4 Taxi Light. - Two taxi lights shall be provided on the nose landing gear.

9.8.5 Wing Inspection Lights. - Lights shall be provided to facilitate inspection of the wing leading edges.

9.9 Interior Lighting. - Only provisions for interior lighting shall be made. Emergency exit lights shall be provided at the main entrance door and at the third window on the starboard side.

9.9.1 Cockpit. - A dome light shall be provided for general illumination in the cockpit.

(1) All control and instrument areas shall be supplied with illumination and suitable controls.

(2) Two flashlights shall be furnished, one on each side of the cockpit.

(3) Spare lamps for use in the cockpit shall be provided and readily accessible.

9.9.2 Cabin Lighting. - Cabin lighting shall be provided by the distributor.

9.10 Receptacles

9.10.1 External Power Supply. - A receptacle shall be provided on the outboard side of the port nacelle to permit the supply of D.C. power from an external power source. Capacity shall be sufficient to permit full operation of the electrical system. A hinged access door shall be provided for the receptacle.

9.11 Signalling and Warning Systems

9.11.1 Testing. - The warning and advisory lights are located on light panels and shall be tested simultaneously by actuation of a single test switch. Duplicate switches shall be provided for the pilot and copilot. Exceptions to this testing procedure are those lights normally tested with their related system.

9.11.2 Landing Gear Warning System. - The landing gear signal system shall provide for lighting of a dual green indicator light for each gear when the gear is extended and locked. At all other times, except when the gear is in the fully retracted position, a red warning indicator light in each landing gear handle shall light to indicate an unsafe landing condition. The green indicator lights shall be located on the copilot's instrument panel skirt. A warning horn will sound if both throttles are retarded with any gear not locked down. A silencing circuit, actuated by a pushbutton, shall be provided. A warning light to denote use of this circuit shall also be provided. Two amber indicator lights denoting left and right "speed brakes down" shall be provided on the pilot's instrument panel skirt. The warning horn will be acutated by the extension of flaps past takeoff position (by either extension system). When so actuated, the horn silencing circuit will be inoperative.

9.11.3 Engine Fire Warning System. - Dual red warning lights shall be provided at each selector handle to indicate a fire in their respective engine nacelles. A fire warning test switch shall be provided for checking all engine fire warning circuits simultaneously.

9.12 Bonding. - Bonding of the airplane shall be in accordance with G.A.E.C. Standard Process Specification #5-4, and MIL-B-5087A(ASG)-1.

10.0 ELECTRONICS

10.1 Description. - For purposes of establishing weight allowances, arrangements and extent of design, the following equipment described herein is specified.

10.1.1 The following list of typical systems has been selected.

V.H.F. Communication	Dual Systems
V.H.F. Navigation	Dual Systems
A.D.F.	Dual Systems
Glide Slope Receiver	Dual Systems
Marker Beacon	(1) System
Intercommunication	(1) System
Weather Radar	(1) System
Autopilot	(1) System
Compass	Dual System
Distance Measuring Equipment	(1) System
A.T.C. Transponder	(1) System

10.1.2 Workmanship. - Any electronic installation shall be completed in accordance with accepted standards of workmanship and in accordance with vendor's written equipment specifications. Approval of the installation by the F.A.A. shall be considered as final.

10.2 Equipment Rack. - Space provisions for all communication, navigation and radar receivers, transmitters, and amplifiers shall be located in the radio rack area on the right hand side of the airplane just aft of the cockpit.

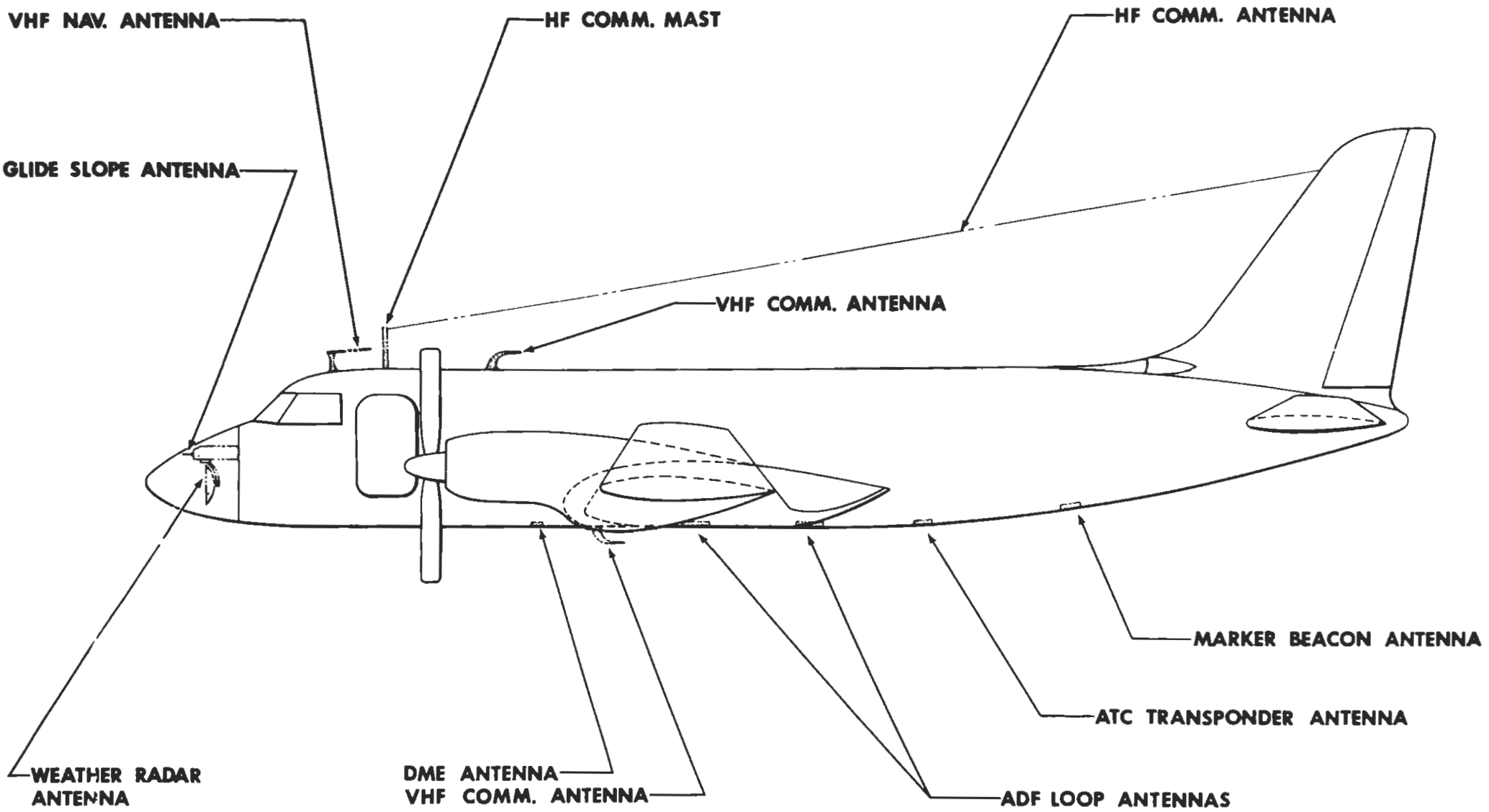
10.3 Control Panels. - Space provisions for electronic system control panels are made for the pilot and/or copilot.

10.4 Antennas. - Space and some structural mounting provisions shall be provided for the antennas illustrated in the diagram on page 57.

10.5 Radome. - A combination radome shall be provided for operation with either C-band or X-band radar. The radome shall be made of fiberglass and shall be the nose of the airplane.

10.5.1 Wave Guide. - A wave guide transmission line, accomodating both "C" and "X" band radar, shall be provided to connect the radome area in the nose with the equipment area.

10.6 Intercommunications. - There will be a phone jack in the nose wheelwell for ground service use.



SUGGESTED ANTENNA LOCATIONS

10.7 Wire. - 22 gage wire may be used for instrumentation and other low power signal circuits in the radio system.

10.7.1 Terminal Panel. - A terminal panel box shall be provided on the aft side of Bulkhead 193 for making future connections.

10.8 Precipitation Static Control. - Antiprecipitation static systems utilizing approved components, shall be provided and shall include wick dischargers where appropriate. The exterior of the airplane and the location of all antennas shall be such as to minimize the generation and coupling of corona-type interference.

11.0 FLIGHT STATION

11.1 Cockpit. - The cockpit shall be arranged to permit the unrestricted movement of controls through their specified ranges. Special attention shall be given to locating each control or instrument in a position accessible to or visible by the crew member chiefly responsible for each function. Operation of the standby magnetic compass shall comply with CAR.

11.2 Instrument and Control Panel. - Instruments and system controls are arranged in main groups in general accordance with the following drawings:

(1) Instrument Panel
(2) Overhead Panel
(3) Center Control Console
(4) Pilot & Copilot side Console Panels
(5) Radio Control Panel

11.3 Engine and Fuel System

11.3.1 Engine and Fuel Instruments. - Engine and fuel instruments shall be located in the center section of the main instrument panel for maximum convenience of the pilot and copilot. Starting system controls shall be located on the lower overhead center console panel.

11.3.2 Engine Power Lever. - The engine power lever installation shall be on the pedestal.

11.3.3 Emergency Shut-Off Handles. - Emergency firewall shut-off handles shall be provided above the engine instrument panel, one handle for each engine, to provide for engine shut-down, fuel and water/methanol shut-off, electrical disconnect and indirectly feathering the propeller and exposing the fire extinguisher system switch in the event of fire or other emergency.

11.4 Flight Instruments and Controls

11.4.1 Flight Instruments. - The essential flight instruments shall be arranged in a "Basic T" form in accordance with CAR Part 4b.611 as per CAR Amendment 4b.7 and centered with respect to the pilot's eye.

11.4.2 Radar Scope. - Scope provisions shall be made for a radar scope installation in the center of the main instrument panel.

11.4.3 Flight Controls. - Dual control wheel columns, rudder pedals, and elevator trim control wheels shall be provided for the pilot and the copilot. A lever for control of the wing flaps shall be provided on the right side of the vertical face of the center pedestal. A lever for control of the speed brake shall be provided on the left side of the vertical face of the center pedestal.

INSTRUMENT PANEL

* 1 Airspeed Indicator
* 2 Gyro Horizon Indicator
* 3 Altimeter
* 4 Clock
* 5 RMI
* 6 Course Indicator
* 7 Vertical Speed Indicator
* 8 Turn & Bank Indicator
* 9 DME Indicator
10 Airspeed Limitations
*11 Marker Beacon Lights
*12 VOR - ADF Switch
*13 Turn & Bank DC Warning
*14 Directional Gyro Slave Indicator
*15 Directional Gyro Slave Switch
16 Static Pressure Selector Switch
17 Outside Air Temp Gage
18 Water/Methanol Quantity Gage
19 Turbine Gas Temp Indicator
20 Torque Meter
21 Tachometer
22 Fuel Flowmeter
23 Oil Pressure Gage
24 Oil Temp Gage
25 Not Used
26 Fuel Quantity Gage
27 Fuel Datum
28 Flap Position Indicator
*29 Cabin Call
30 Compass Correction Card
*31 Radar Scope
32 Oxygen Flow Indicator
33 Oxygen Pressure Indicator
34 Oxygen Valve Open-Close
35 Emerg Hydraulic Pressure Indicator
36 Normal Hydraulic Pressure Indicator
37 Hydraulic Pump Off-On Switch
38 Landing Gear Selector Handle

40 Wheel Light Intensity - Dim Bright Switch
41 Wheel Indicator Lights
42 No Horn Light
43 Horn Cutoff Switch
44 Speed Brake Warning Lights

PILOT'S SIDE CONSOLE

45 Master Caution Light Display Panel
46 Emerg Hydraulic Pump Switch
47 Nose Wheel Power Steering On-Off Switch
48 Nose Wheel Steering Control
*49 Trip & Data Encoder
*50 Flight Data Recorder Switch
51 Spare Light Panel
52 Air Conditioning Inlet
53 Spare Panel
*54 Oxygen Mask & Hose Stowage
55 Oxygen Regulator
56 Map Case

66 Instrument Panel Red Engine Rheostat
67 Instrument Panel Red Flight Rheostat
68 Instrument Panel Red Flood Rheostat
69 Instrument Panel White Flood Rheostat
70 Map Light
71 Map Light Switch

159 Side Console Red Flood Rheostat
160 Side Console White Flood Rheostat

COPILOT'S SIDE CONSOLE

45 Master Caution Light Display Panel

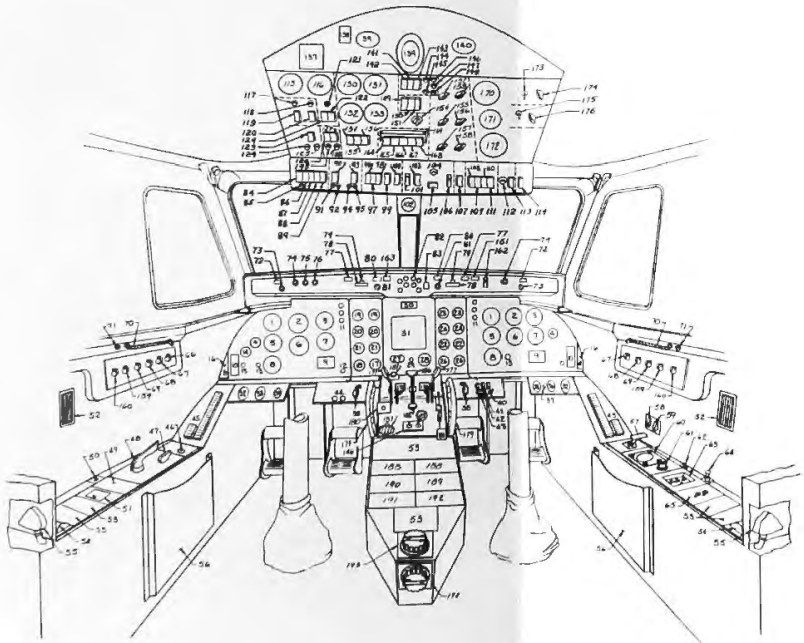
52 Air Conditioning Inlet
53 Spare Panel
*54 Oxygen Mask & Hose Stowage
55 Oxygen Regulator
56 Map Case
57 Emerg Gear Extension Handle
58 Cabin Blower On-Off Switch
59 Air Conditioning & Vent Switch
60 Cabin Pressure Controller
61 Manual Cabin Pressure Control
62 Stall Warning Test Switch
63 Emerg Deicing Panel Wing & Tail
64 Emerg Flap Control Handle
*65 Flight Recorder-Pitot-Static Switch
67 Instrument Panel Red Flight Rheostat
68 Instrument Panel Red Flood Rheostat
69 Instrument Panel White Flood Rheostat
70 Map Light
71 Map Light Switch

159 Side Console Red Flood Rheostat
160 Side Console White Flood Rheostat

EYEBROW PANEL

72 Master Warning Light (2)
73 Warning Light Reset (2)
74 Warning Light Test Switch (2)
75 Fire Detection Test Switch
76 Fuel Gage Test Switch
77 Aft Nacelle Fire Warning Light
78 Firewall Shut-Off Handle
79 Fire Extinguisher Actuator Switch
80 Feather Pump Light
81 Feathering Pump Switch
82 Propeller Lights
83 Propeller Flight Safety Lock Switch

161 APU Fire Warning Light
162 APU Fire Extinguisher Switch
163 Synchronize Switch



* Space Provisions Only

LOWER OVERHEAD PANEL

• Landing Lights
84 Left On-Off Switch
85 Lights Extended Light
86 Right On-Off Switch
87 Left Extend-Retract Switch
88 Right Extend-Retract Switch
89 Taxi Light On-Off Switch

• Windshield Heat
90 Norm-Emerg Heat Switch
91 Left Direct Vision Heat Light
92 Left Front Heat Light
93 Deice-Defog Heat Switch
94 Right Front Heat Light
95 Right Direct Vision Heat Light

• Lights
96 Navigation On-Off Switch
97 Wing On-Off Switch
98 Passenger Warning-Seat Belts-No Smoking Switch
99 Anti-Collision-All On-Bottom Only Switch
100 Wht Override All On-All Off Switch

• Engine Start
101 Left Air Start On-Off Switch
102 Standby Compass
103 Start Selector Start-Crank Switch
104 Start Button
105 Left Off Right Engine Selector Switch
106 Right Air Start On-Off Switch

• Fuel Boost Pumps
107 Door Safe-Unsafe Switch
108 Left Norm On-Off Switch
109 Left Auxiliary On-Off Switch
110 Right Norm On-Off Switch
111 Right Auxiliary On-Off Switch

• Fuel Crossfeed
112 Open Light
113 Open-Close Switch
114 Water Methanol Armed-Off Switch

UPPER OVERHEAD PANEL

• Pneumatic Boots
115 Pressure Gage
116 Suction Gage

121 Tail Boot Indicator Light
122 On-Off Wing & Tail Switch

129 Heavy-Light Ice Wing & Tail Switch

• Deicing
117 Engine & Prop Left Deice On Light
118 Engine & Prop Right Deice On Light
119 Left Engine & Prop Deice Slow-Off-Fast Switch
120 Right Engine & Prop Deice Slow-Off-Fast Switch

123 Deice Pitot Heat On-Off Switch
124 Left Pitot Heat Light
125 Right Pitot Heat Light
126 Left Fuel Filter Auto On Switch
127 Right Fuel Filter Auto On Switch
128 Right On Fuel Filter Light

195 Left On Fuel Filter Light

UPPER OVERHEAD PANEL (CONT'D)

• Electrical
130 Left Gen Volt-Ammeter
131 Right Gen Volt-Ammeter
132 APU Gen Amps & DC Bus Voltmeter
133 AC Voltmeter
134 Superv Left Gen On-Off Reset Switch
135 Superv On-Off-Ext Power Switch
136 Superv Right Gen-On-Off-Reset Switch

149 Radar Bus Norm-Off-Standby Switch
150 Main Bus Norm-Off-Standby Switch
151 Essential Bus Norm-Off-Emerg Switch

154 AC Volt Selector

164 Elec Master Left Alt On-Off
165 Elec Master Left Gen Off-Trip Switch
166 Elec Master Battery Norm-Off-Emerg Switch
167 Elec Master Right Gen Off-Trip Switch
168 Elec Master Right Alt On-Off Switch
169 Emerg Power-Cutoff Bar

• Auxiliary Power Unit
141 Gen On-Off Switch
142 Air On-Off Switch
143 Master On-Off Switch
144 Oil Pressure Light
145 APU Start Button
146 Start Light
147 Oper RPM Light
148 Gen Off Light

• Cockpit Lights
151 Pedestal Edge Light Rheostat
152 Pedestal Flood Light Rheostat
153 Overhead Flood Light Rheostat

155 Overhead Panel Edge Light Rheostat
156 Eyebrow & Lower Overhead Edge Rheostat

158 Pedestal Radio Edge Light Rheostat

PRESSURIZATION

170 Diff Pressure & Cabin Alt Indicator
171 Cabin Temp Gage
172 Cabin Rate Of Climb Indicator
173 Cabin Temp Incr-Decr-Auto Switch
174 Cabin Temp Rheostat
175 Cockpit Temp Incr-Decr-Auto Switch
176 Cockpit Temp Rheostat

OVERHEAD CONSOLE PANEL

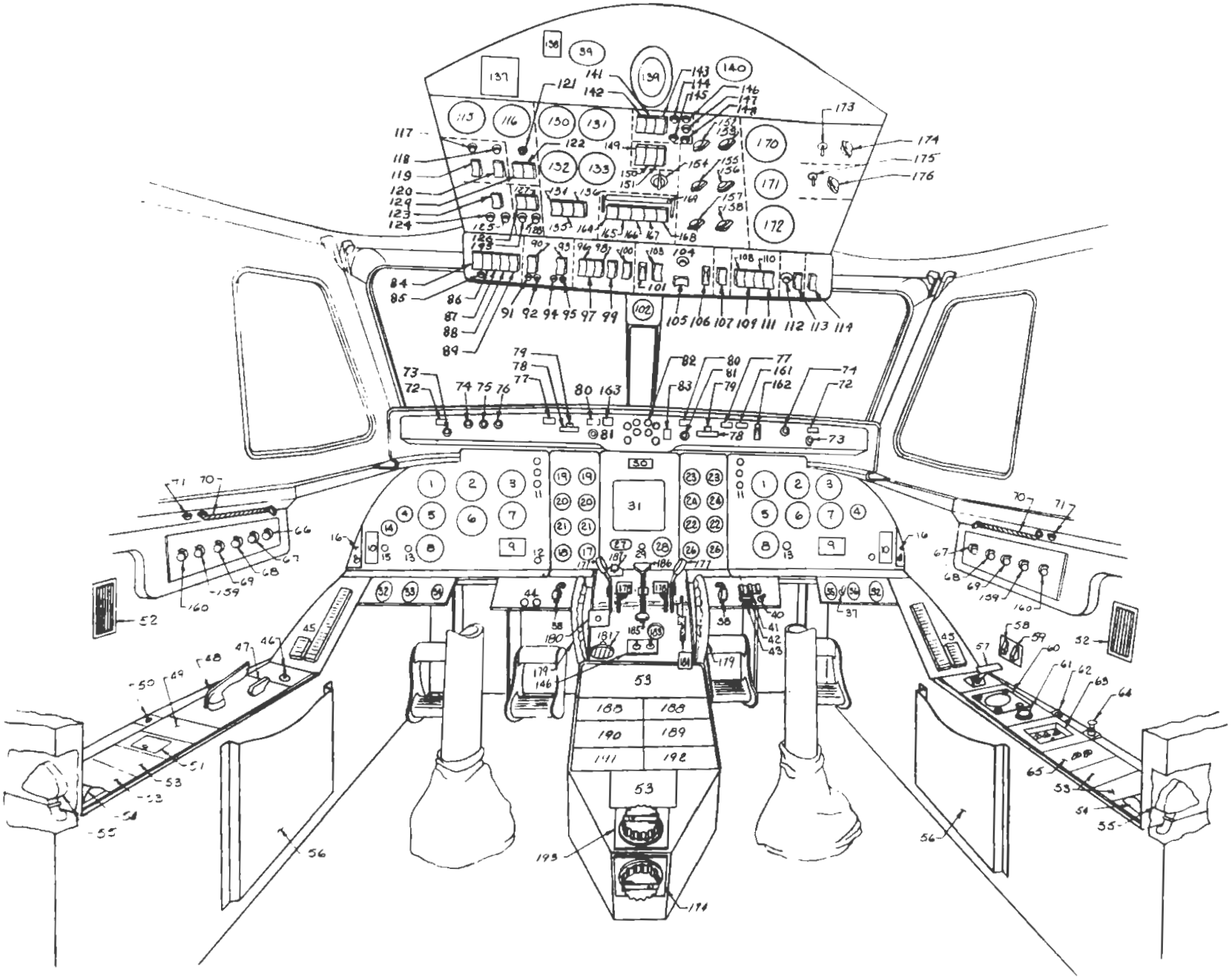
137 Engine Limitation Card
138 Altitude Variation Card
139 Pedestal Flood Light
140 Landing Gear Warning Horn

39 Over Speed Warning Horn

CENTER CONTROL PANEL

177 High Pressure Fuel Cock Left/Right Engine
178 Throttle Levers
179 Elevator Tab Control Wheel Pilot
180 Speed Brake Control Handle
181 Parking & Emerg Brake Control Handle
182 Fuel Trim Switches
183 Throttle Lever Friction Knob
184 Flap Control Lever
185 Fine Pitchlock Selector
186 Gustlock Control Lever
187 Windshield Wiper Speed Control
*188 Audio Control Panels
*189 VHF Communication Control Panel
*190 VHF Navigation Control Panel
*191 ADF Control Panel
*192 Transponder Control Panel
193 Rudder Trim Control
194 Aileron Trim Control

Flight Station General Arrangement



* Space Provisions Only

11.4.4 Autopilot. - Space and some structural provisions for Collins (AP101E/AP-103 or Sperry SP-20/SP-40) autopilot control shall be provided on the middle portion of the center pedestal.

11.5 Propeller Control. - Propeller feathering shall be initiated by the high pressure fuel cock on the center pedestal. (See paragraph 5.2.2.)

11.6 Functional Systems. - In general, airplane functional system controls shall be located on overhead panels and side consoles. These panels shall be tilted to an appropriate angle to afford visibility for crew members insofar as practical. Associated controls shall be grouped and systems shall be segregated insofar as practical.

11.6.1 Electric Control Panel. - Electric system controls shall be located in a panel on the overhead console to the left of the airplane centerline.

11.6.2 Engine Starting Panel. - The engine starting panel shall be located on the overhead panel on the airplane centerline.

11.6.3 Radio Controls. - A production arrangement of the radio controls is shown in the diagram on page 60.

11.6.4 Air and Heat System Controls. - Controls for wing and empennage deicing, engine induction scoop and propeller anti-icing, shall be provided on the overhead control panel. Pressurization and air conditioning controls shall be provided to the right of the airplane centerline on the overhead console.

11.6.5 Hydraulic System Controls. - Hydraulic pressure gages and auxiliary hydraulic pump switch shall be provided on the copilot's right instrument panel skirt, and on the left console.

11.7 Landing Gear Controls. - Dual landing gear controls shall be located on the skirt panels outboard of the center instrument panel. The levers shall be spring-loaded so that they require a distinct lateral motion to move them from detents at the up and down positions.

11.8 Wheel Brake Controls

11.8.1 Normal Brake Control. - Normal wheel brake control shall be provided for both pilots, integral with the rudder pedal system.

11.8.2 Emergency Brake. - The auxiliary pump switch will act as the emergency brake system supply and shall be located for use by the copilot or the pilot.

11.8.3 Parking Brake. - A latch type control for setting the parking brake shall be provided for the pilot.

11.9. Crew Accommodations. -

11.9.1 Seats. - Chairs for the pilot and copilot shall be provided and shall be adjustable vertically fore and aft. Each chair shall have hinged armrests. The chair back, armrests and seat shall be padded.

11.9.1.1 Harness. - A shoulder harness, lap belt and crotch strap shall be provided for the crew seats. An inertia reel shall be installed on each chair.

12.0 FURNISHINGS

12.1 General Interior Arrangement. - The interior arrangement of the airplane shall be chosen through the distributor. The interior furnishings of the airplane shall be furnished by the distributor. The general arrangement of the interior shall be as follows:

An enclosed cabin in the forward portion of the fuselage for the pilot and copilot seated side by side.

A passenger compartment in the main fuselage containing a passageway between the forward cabin and aft compartments readily accessible during flight. Baggage space shall be provided, as required, within the pressurized hull with internal and external access.

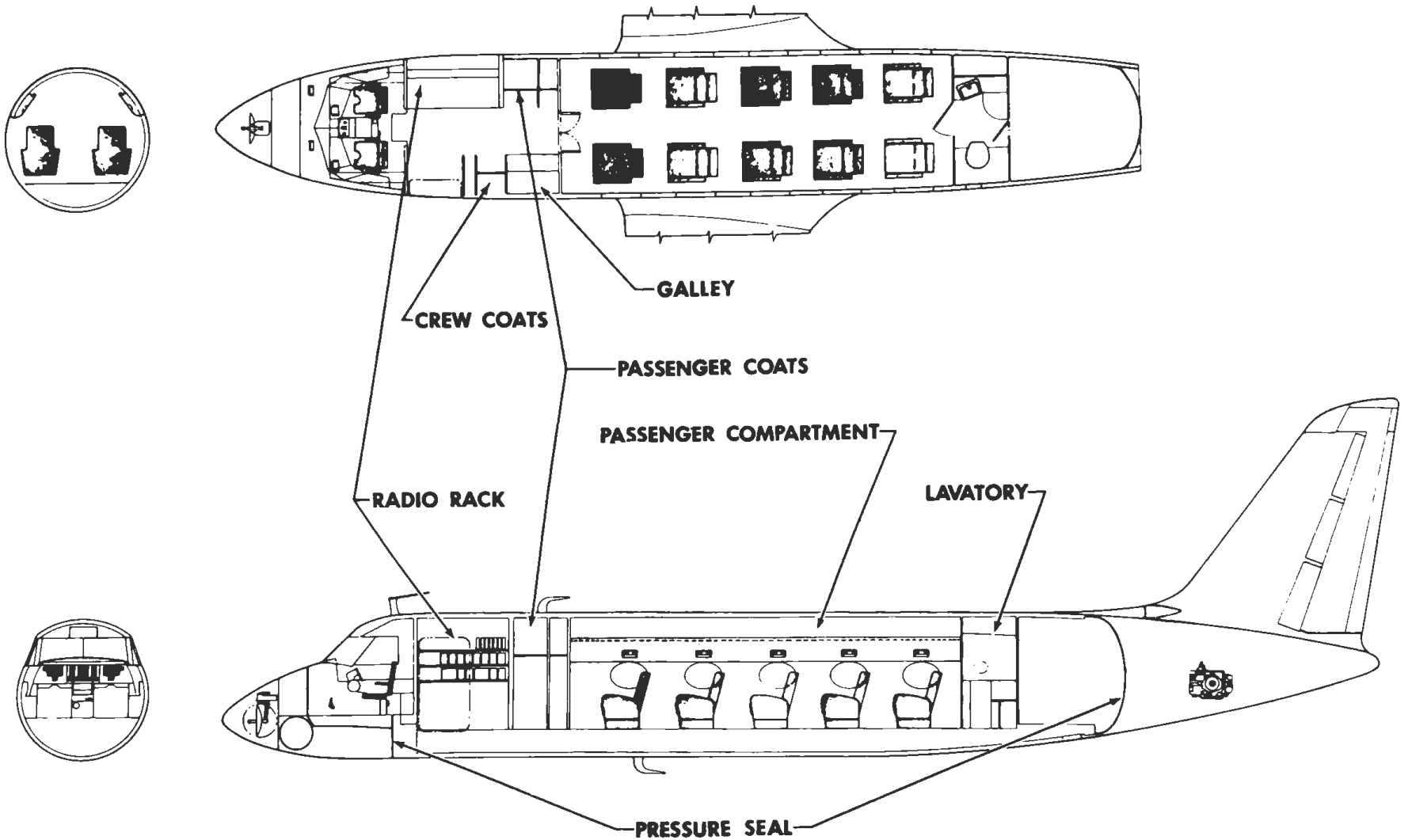
12.2 Oxygen Equipment Installation. - The oxygen equipment shall consist of the following:

Cabin shut-off valve	(1)
48.3 ft.^{3} oxygen cylinder	(1)
Oxygen pressure indicator	(1)
Flow Indicators	(2)
Demand-type regulators for the crew	(2)
Bottle shut-off valve	(1)

12.3 Fire Detection & Extinguishing Systems. - Each nacelle is provided with two continuous-type fire detecting systems fore and aft and a two-shot fire extinguishing system. The auxiliary power unit, located in the tail of the airplane, is provided with a fire detection system and a one-shot fire extinguishing system. Two hand fire extinguishers shall be provided.

12.4 Windshield Wipers. - Windshield wiper systems shall provide acceptable vision in heavy rain during approach, landing, take-off, and taxi conditions.

12.5 Thermal and Acoustical Insulation. - Thermal and acoustical insulation design information will be supplied.



TYPICAL 10 SEAT ARRANGEMENT

13.0 PRESSURIZATION & AIR CONDITIONING

13.1 Pressurization

13.1.1 Pressure Sources. - An engine-driven supercharger acts as a source of pressurized air. There is an auxiliary power unit installed to act as a second source.

13.1.1.1 Supercharger. - The gearbox-driven supercharger is mounted on the accessory gearbox in the starboard nacelle. It is a positive displacement Roots-type compressor. The compressor can be pneumatically unloaded from the gearbox by means of a cockpit switch whenever maximum power is required from the engines.

13.1.1.2 Auxiliary Power Unit. - The auxiliary power unit is a gas turbine compressor located in the tail of the airplane. The A.P.U. operates from the main fuel tanks on the same fuels as used by the main engines. It is fully enclosed and has fire detection and a one-shot fire extinguishing system. In addition to providing pressurized air, the A.P.U. also provides 200 amps of D.C. power.

13.1.2 Pressure Schedule. - Maximum normal differential is 6.55 psi, which can maintain a sea level cabin up to 15,500 feet and an 8000-foot cabin at 30,000 feet. Emergency relief valve setting is 7.2 psi. Negative pressure relief is set at 0.20 psi.

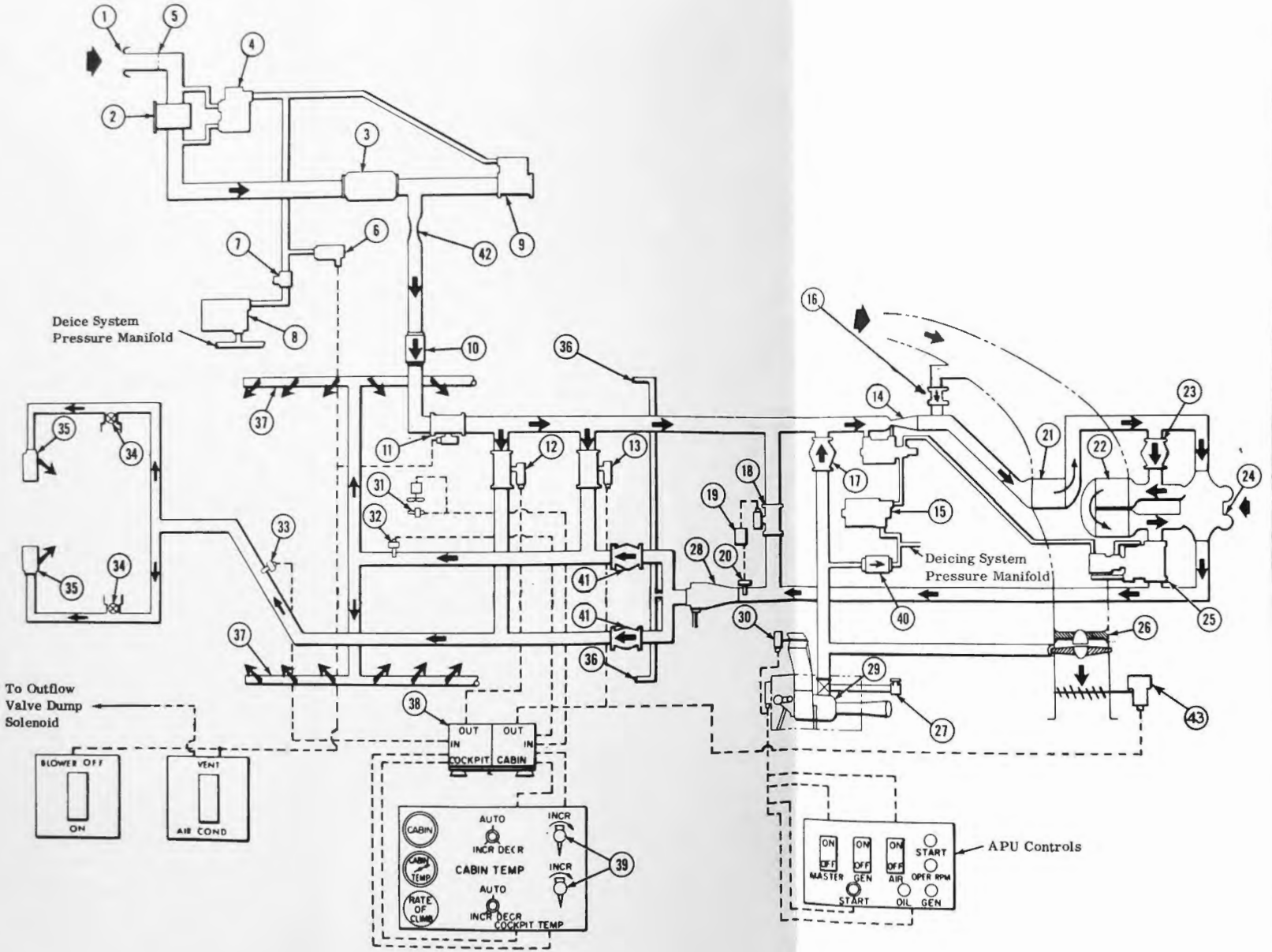
13.1.3 Pressure Controls. - The cabin pressure controls enable the pilot to vary his isobaric range from sea level to 8000 feet and rate of cabin altitude change from 50 ft/min to 2000 ft/min within the control capacities stated in paragraph 13.1.2. Provision is also made for dumping cabin pressure and manual operation of pressure controls in the event of malfunction of the automatic controls.

13.1.4 Pressurization Indicators. - Indicators located in the cockpit will show cabin altitude, pressure differential to ambient and rate of cabin altitide change. The pressure differential indicator is color-coded to indicate when the maximum normal pressure differential of 6.55 psi is exceeded. A warning light indicates that cabin altitude exceeds 10,000 feet.

13.2 Air Conditioning

13.2.1 Cooling. - Cooling is provided by a bootstrap air cycle system employing water separation to reduce humidity. The cooling equipment may be operated from either of the two pressure sources mentioned in paragraph 13.1.1. In the event of cooling equipment failure, the airplane may be ventilated with ram air.

13.2.2 Heating. - Heating is accomplished solely by the heat of compression supplied by the pressure sources.



1 Ram Scoop
2 Cabin Supercharger
3 Silencer
4 ΔP Sensor
5 Intake Screen
6 Solenoid Valve
7 Tee Orifice
8 Pressure Regulator
9 Compressor Dump Valve
10 Check Valve
11 Shut-Off Valve
12 Cockpit Temp Control Valve
13 Cabin Temp Control Valve
14 Low Flow Sensor
15 Pressure Regulator
16 Ram Air Valve
17 Check Valve
18 Water Separator Anti-Ice Valve
19 Control Box (Water Separator)
20 Water Separator Temp Sensor
21 Primary Heat Exchanger
22 Secondary Heat Exchanger
23 Check Valve
24 Bootsrap Unit
25 Low Flow Bypass Valve
26 Ground Fan
27 Air Flow Control
28 Water Separator
29 Auxiliary Power Unit
30 Auxiliary Power Unit Inlet Door Actuator
31 Cabin Thermostat
32 Cabin Duct Anticipator
33 Cockpit Duct Sensor
34 Cockpit Side Diffusers
35 Cockpit Foot Outlets
36 Eyeball Supply Lines
37 Cabin Distr Louvres
38 Temperature Control Box
39 Selector Rheostats
40 Check Valve
41 Check Valve
42 Flow Limit & Heating Venturi
43 Ram Air Limiter Actuator

Air Conditioning & Pressurization System Schematic

13.2. Temperature Control. - Separate temperature control is provided for cockpit and cabin. In both cases, this control may be operated either automatically or manually

13.2.4 Ground Operation. - The airplane is completely self-sufficient as regards to ground air conditioning without the necessity of operating the main engines. This is accomplished by means of the auxiliary power unit mentioned in paragraph 13.1.1.2.

13.2.5 Air Distribution. - Low velocity air enters the cabin on both sides through distribution louvers spaced along floor-level ducts. It is exhausted through overhead ducts and is directed below the floor, through the radio rack area, and discharged overboard via outflow valves.

Air is introduced into the cockpit from outlets forward of the pilot's and copilot's feet and from adjustable outlets above the side consoles. Air from the cockpit area is exhausted through the radio rack to the area of the outflow valves whence it is discharged overboard. Electronic cooling may thus be effected without taking the heat load into the occupied spaces.

13.2.6 Temperature Indicators. - A temperature indicator located in the cockpit will show cabin temperature.

14.0 ICING PROTECTION & DEFOGGING

14.1 Wings and Tail. - Icing protection of the wings and tail is provided by a high pressure pneumatic boot deicing system. The wing boots employ chordwise inflatable tubes while the inflatable tubes in the tail run spanwise. Both wing and tail boots are flush mounted, the exterior surface of the boot forming part of the airfoil so that the boots impose no drag on the airplane. When the boots are not being used, they are held flush to the leading edge by the vacuum system.

The boots are inflated by engine bleed air manifolded in such a manner that boot operation is available during single engine flight. The wing and tail boot deicing system is in general accordance with the drawing on page 69.

14.1.1 Controls. - Inflation of the boots is accomplished by means of solenoid valves whose operation is timed electronically. Two speeds of boot operation are available to the pilot by means of a cockpit switch.

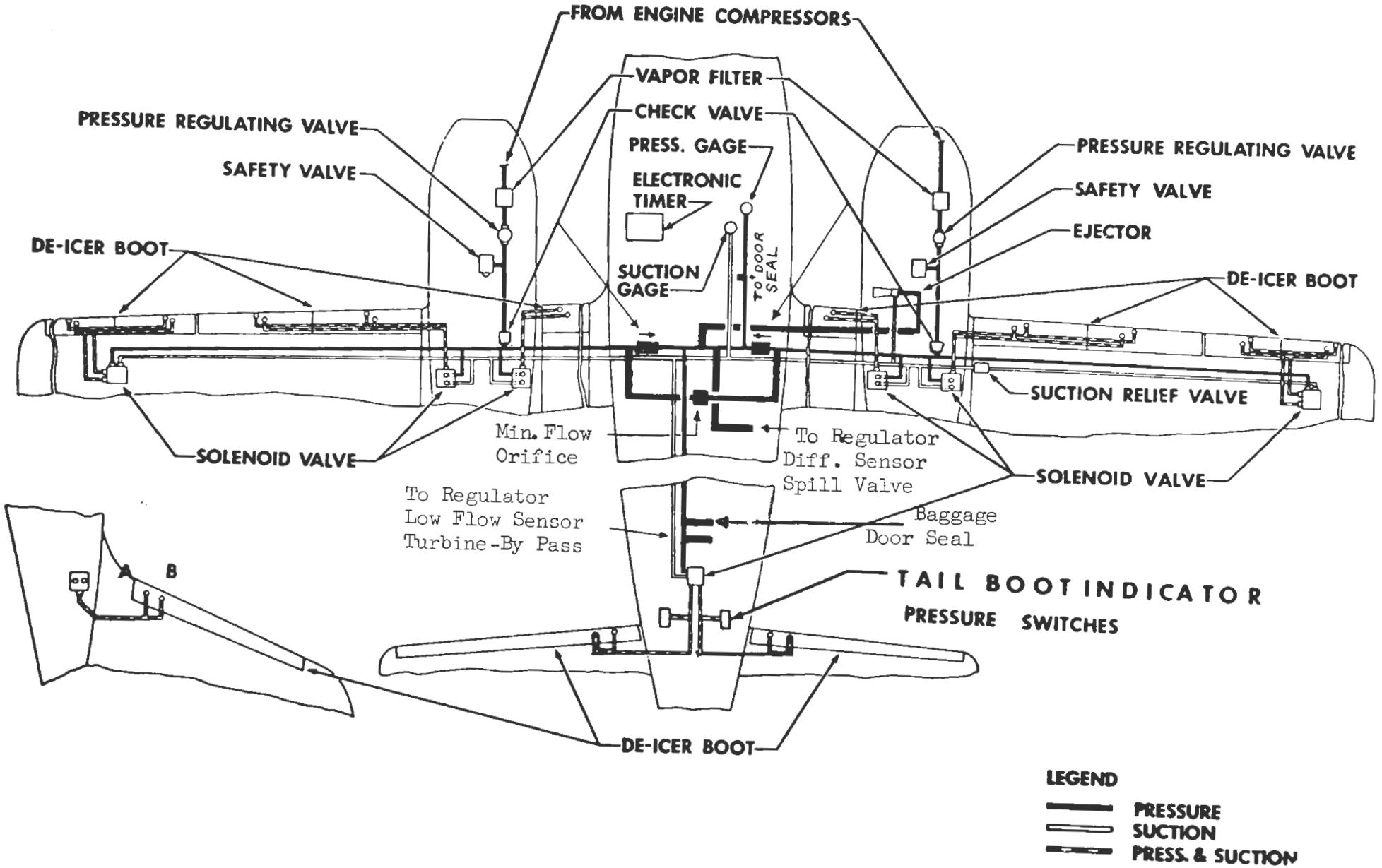
14.1.1.1 Boot Operation Speeds. - When operated at heavy icing speed, each boot on the airplane is cycled once every 60 seconds. When operated at light icing speed, each boot is cycled once every 240 seconds. In addition, separate manual controls are provided.

14.1.1.2 Boot System Indicators. - Gauges located in the cockpit indicate the pressure in the pressure and vacuum manifolds supplying the boots. Inflation of the wing boots may be observed visually (with wing inspection lights during night operation). Inflation of the tail boots is indicated by a light in the deicing system control panel.

14.2 Windshield Anti-Icing. - Anti-icing protection for the front windshield and clear vision panels is provided by means of electrically conductive heating films imbedded in the glass. Once windshield anti-icing has been selected by means of a cockpit switch, the flow of electrical power to the film is thermostatically controlled at the proper levels. Independent circuits serve the front windshield panels and clear vision windows so that a failure in one panel does not affect the other.

14.3 Defogging of Cockpit Glass. - Defogging of the front windshield, the clear vision panels and the optional electrically heated side windows is provided by electrically conductive films in the same manner as the anti-icing mentioned in paragraph 14.2 Once defogging has been selected by means of a cockpit switch the flow of electrical power to the films is thermostatically controlled at the proper levels.

14.4 Cabin Windows. - Fogging of the cabin windows is prevented by keeping the air space between the panes free of moisture. This is provided by a desiccator system which dries the air between the panes.



Wing and Tail Deicing System

EQUIPMENT APPENDICES

Appendices A thru E list the major items of equipment furnished by G.A.E.C. Space provisions only are made for those items preceded by a single asterisk. These items are subject to customer selection and are not provided as part of the basic delivered airplane. Items listed in Appendix F constitute a ferry kit (flyaway package) necessary for delivery to a distributor.

APPENDIX A

POWER PLANT

Quantity	Item	Mfr.	P/N
2	Alternators (Propeller Synchronizing)	Rotol	SNA/4
2	Alternators (Engine & Windshield Anti-Icer)	Rotax	BA1001
2	Engines, Turboprop	Rolls-Royce	Dart Mark 529-8X
2	Gearboxes	Rotol	PTG14/8
2	Gearbox Drives	Rotol	GD20/3
2	Generators, DC	Jack & Heintz or Bendix	30007-003 or 30E20-41A
2	Generators, Tachometer	Kelvin Hughes	KGA0401
2	Propellers	Rotol	R184/4-30-4/50
4	Pumps, Booster	Lear or Pesco	RR12030 or 123571-110-01
2	Spinners	Rotol	RCM/69
1	System, Engine Control	GAEC	159P10075
1	System, Fuel	GAEC	159P10005
2	Systems, Starting	Rolls-Royce	159P10021
1	System, Water/Methanol	GAEC	159P10010

APPENDIX B

INSTRUMENTS

Quantity	Item	Mfr.	P/N
*2	Altimeters, Barometric	Kollsman	2371-10-02
*2	Clocks, Aircraft Mechanical	Waltham	A-13A
*1	Compass, Magnetic Standby	Kollsman	1980U-10-01
1	Gage, Deicer Pressure	U.S. Gage	159SCF105-17
1	Gage, Ldg. Gear Emerg. Air Bottle	U.S. Gage	159SCF105-21
*2	Indicators, Airspeed	Kollsman	865-F-10-075
*2	Indicators, Gyro Horizon	Sperry	H-6B
1	Indicator, Auxiliary Hyd. Press.	U.S. Gage	159SCF105-13
1	Indicator, Brake Accumulator Press.	U.S. Gage	159SCF105-11
1	Indicator, Cabin Rate-of-Climb	Pioneer Central	1634-1AL-C1-1
1	Indicator, Cabin Temperature	Weston	727-62H
*1	Indicator, Course	Aircraft Radio	IN-10
1	Indicator, Deicer Suction	U.S. Gage	159SCF105-19
1	Indicator, Diff. Press. & Cabin Altitude	Kollsman	159SCF103
*1	Indicator, Direction	Aircraft Radio	IN-12
1	Indicator, Flap Position	Liquidometer	EA321-26
1	Indicator, Fuel Datum	Smiths	PW/579FL/CP
2	Indicators, Fuel Flow	Eclipse-Pioneer	25101-B3B-2-2B
2	Indicators, Fuel Quantity	Liquidometer	B118-75
*2	Indicators, Gyro Direction	Sperry	669926-6
1	Indicator, Normal Hyd. Press.	U.S. Gage	159SCF105-15
2	Indicators, Oil Press.	Smiths	159SCF104-13
2	Indicators, Oil Temp.	Weston	159SCF106-13
1	Indicator, Outside Air Temp.	Weston	159SCF106-11
1	Indicator, Radio Magnetic	Bendix	MN 72G-1
*2	Indicators, Rate-of-Climb	Kollsman	E07163-10-055
2	Indicators, Torque Press.	Smiths	159SCF104-11
2	Indicators, Turbine Gas Temp.	Weston	159SCF106-15
*2	Indicators, Turn and Bank	R. C. Allen	RCA-28W2-A2A
1	Indicator, Water/Methanol Qty.	Liquidometer	EA148AN-124H
1	Sensor, Airspeed	Aero Mechanisms	6330-G-1
2	Tachometers	Smiths	159SCF104-15
2	Valves, Static Press. Selector	Republic	11-254-5
1	Voltmeter, AC	AIDS	1209230-M
1	Volt-Ammeter, DC, APU	AIDS	159SCF107-13
2	Volt-Ammeters, DC	--	NAF1225-300

APPENDIX C

ELECTRICAL EQUIPMENT

Quantity	Item	Mfr.	P/N
2	Batteries, 24V. Nickel Cadmium	Sonotone	W-16148
As Req'd	Bolt-Lites, Instrument	Glar-Ban	GB-5952-R-28
4	Controllers, Windshield Heat	United Control	A-706-1
*1	Controller, Windshield Heat (Optional)	United Control	A-706-1
7	Detectors, Heat, Gen., Alt. and Radio Rack	Fenwal	67121-14-200, -300, -410
1	Horn, Landing Gear Warning	Sperti-Farraday	430 M1
1	Horn, Overspeed Warning	GAEC	159AV10644-3
1	Inverter, 250VA	Leland Airborne Products	MGH-229-100 or SE-16-3
2	Inverters, 2500VA	Leland Airborne Products	MGE-23-400
3	Lights, Anti-Collision	GAEC	159 RDAV 104 41150-1(1)
1	Light, APU Fire Warning	Korry	204CG3-7
2	Lights, Emergency Escape	Life-Lite	400-7A
2	Lights, Aft Nacelle Fire Warning	Korry	204CG3-9
2	Lights, Feathering Pump	Korry	204CG3-5
As Req'd	Lights, Flight Station	Grimes	--
2	Lights, Landing	GAEC	159 RDAV 100
3	Lights, Landing Gear Indicating	Korry	204CG3-1, -2, -3
2	Lights, Map	Glar-Ban	5952-MW-28-GR
2	Lights, Navigation, Wing	Grimes	B-7715-1, -2
1	Light, Navigation, Tail	Grimes	B-7890-1
1	Light, No Horn Warning	Korry	204CG3-4
2	Lights, Speed Brake Indicating	Dialight	112-3830-113
2	Lights, Taxi	Grimes	D-7585-3, -5
As Req'd	Lights, Warning (Console)	--	--
2	Lights, Warning (Master)	Korry	204CG3-8
4	Lights, Wing Inspection	Grimes	30960(2), 30965A (2)
4	Power Units, Windshield Heat	United Control	B-707-1B or -1C (2) B-708-1A or -1B (2)
*1	Power Unit, Windshield Heat (Optional)	United Control	B-709-1
2	Regulators, Voltage	Eclipse	1588-2E
2	Regulators, Voltage AC	Bendix	50/55341E
1	Regulator, Voltage, APU	Eclipse	1588-2E
1	Switchbox, Windshield Heat	United Control	A-715-1

APPENDIX D

ELECTRONIC EQUIPMENT

Quantity	Item	Mfr.	P/N
*1	Autopilot	Collins Radio	AP-103
*2	Automatic Direction Finder (ADF) Systems	Collins Radio	DF-203
*1	Air Traffic Control (ATC/IFF) Transponder System	Collins Radio	621-2A
*1	Intercommunication System	Collins Radio	346B-1
*2	Compass	Sperry	C-4A or C-4B
*1	Distance Measuring Equipment (DME) System	Collins Radio	860E-1
*2	Glide Slope Receiver Systems	Collins Radio	51V-4
*1	Marker Beacon System	Collins Radio	51Z-4
1	Radome	Grumman	159SCB102
*2	VHF Communication Systems	Collins Radio	51X-2/17L-7
*2	VHF Navigation Systems	Collins Radio	51X-2/344B-1A
1	Waveguide Transmission Line	Airtron	B580175
*1	Weather Radar	RCA	AVQ-20

APPENDIX E

MISCELLANEOUS EQUIPMENT

Air Conditioning

Quantity	Item	Mfr.	P/N
1	Bootstrap Unit	AiResearch	205710
1	Cabin Supercharger	Sir G. Godfrey	139153 Type 15
1	Gas Turbine Compressor	AiResearch	372940 Incl. Kit No. 378415
1	Ground Fan	AiResearch	207320
1	Heat Exchanger, Primary	AiResearch	170980
1	Heat Exchanger, Secondary	AiResearch	171190
1	Water Separator	AiResearch	171280

Deicing

2	Defogging Cockpit Side Windows	GAEC	159SCCE102
1	Deicer Boot, Fin	B.F. Goodrich	21-843
2	Deicer Boots, Stabilizer	B.F. Goodrich	23-843
10	Deicer Boots, Wings	B.F. Goodrich	22-843
7	Deicer Distributing Valves	Bendix	1532-3
1	Deicer Timer	Bendix	42E06-11
2	Deicing Windshields	GAEC	159SCCE100
2	DV Windows	GAEC	159SCCE101

Furnishings

2	Arms, Windshield Wiper	Alco	XW20814-1, -2 or XW20343-1800B4
2	Blades, Windshield Wiper	Alco	XW20567-110-55
1	Fire Detector System, APU	--	--
2	Fire Detector Systems, Engine(Zone 1 & 2)	Vickers-Armstrong	159P10007
2	Fire Detector Systems, Engine(Zone 3)	Kidde	159P10018
1	Fire Extinguisher, Hand, Chemical	Kidde	870904
1	Fire Extinguisher, Hand, Water	Kidde	890275
1	Fire Extinguishing System, APU	--	159P10017
1	Fire Extinguishing System, Engine & Tailpipe	--	159P10008
2	Links, Windshield Wiper	Alco	XW20016-180
1	Pedestal	Hansen-Lynn	159SCF100-5
2	Reels, Shoulder Harness	American Seating	1101118-0
2	Seat Belt Assemblies (Crew)	--	159SCF102-1
1	Seat, Copilot	Aerotherm or Equiv.	159SCF101-2
1	Seat, Pilot	Aerotherm or Equiv.	159SCF101-1
2	Tubes, Pitot	Kollsman	923-02

Hydraulics

1	Assembly, Air Bottle	Kidde	891104
1	Motor, Flap	Vickers	MS-24-3906-30BC-4

MISCELLANEOUS EQUIPMENT (Cont'd)

Hydraulics (Cont.)

Quantity	Item	Mfr.	P/N
2	Pumps, Engine Driven	N.Y. Air Brake	66 WAY-300-1
1	Pump, Auxiliary	Pesco	159SCH102-3
1	Reservoir	GAEC	159H10051-1,-3
1	Unit, Control	Alco	XW2224-103
2	Units, Window	Alco	XW20654-3,-4 or XW20867-S3,-S4
2	Valves, Brake	Weston	16810
1	Valve, Dump, (Manual Reset) Emergency Landing Gear	--	159SCH112-5
1	Valve, Flap Control	Adel	55960-11
1	Valve, Selector, Door & Stair	Hydra-Power	HP732100-4500
1	Valve, Speed Control, Windshield Wiper	Alco	XW20940 or XW20653-1

Landing Gear

4	Anti-Skid Units (Decelostats)	Westinghouse	P25340, P25341
4	Brakes	Goodyear	9541573,9541731 9541732 or 9542558
2	Drag Braces, Main Gear	Agawam	159L10003
2	Main Struts	Bendix	172242,173576 or 2570894
4	Main Wheels	Goodyear	9531942,9532515 or 9542306
1	Nose Strut	Bendix	172240,173575, 173884 or 2570892
2	Nose Wheels	Goodyear	9531966
1	Power Steering Assembly	Bendix	86550
4	Tires, Main Wheel	Goodyear	7.50x14-12 Ply
2	Tires, Nose Wheel	Goodyear	6.50x 8 - 6 Ply

Oxygen Equipment

1	Cylinder, Oxygen (48 ft.^{3})	Zep-Aero	C250-48
2	Indicators, Oxygen Flow	Zep-Aero	AN6029-1
1	Indicator, Oxygen Pressure	Zep-Aero	AN6011-1B
2	Regulators, Demand Type (Crew)	Alar Products	A12A
1	Valve, Bottle Shut-off	--	AN6012-1A
1	Valve, Filler	Roylyn	3410

Pressurization Control

1	Control, Outflow Valve	AiResearch	102312-655-14
2	Valves, Outflow & Safety	AiResearch	103262-1

APPENDIX F

FLYAWAY PACKAGE

Quantity	Item	Mfr.	P/N
1	Compensator	Sperry	620783
2	Crew Chairs	Flight Line	159RDF217-1
1	Electrical Package	GAEC	159AV10301
1	Flux Gate Valve	Sperry	620359
1	Instrument Panel Box Assembly	GAEC	159F10003-1
1	Marker Antenna 37X-2	Collins	159RDAV108
1	OMNI Antenna	Collins	37J-3
2	Oxygen Masks (Crew)	Zep-Aero	A14A
2	Oxygen Smoke Masks (Crew)	Zep-Aero	No. 16
1	Radio Package	Airmar Radio	Mod. 1040
1	VHF Antenna	Collins	37R-1

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